HAMADRYAD
Vol. 22. No. 1. July, 1997
Date of issue: 31 July, 1997

FULL BOOK SCANNED

CONTENTS

Hamadryad, Vol. 22, No. 1, pp.1 – 8, 1997.

A NEW SPECIES OF *LIMNONECTES* (ANURA: RANIDAE) FROM ORISSA, INDIA

Sushil K. Dutta

Department of Zoology, Utkal University, Bhubaneswar 751004, Orissa, India.
(with five text figures)

ABSTRACT.- A new species of ranid, *Limnonectes orissaensis* (Anura: Ranidae) of the *L. limnocharis* complex, is described from Orissa State, eastern India. The new species is the largest among members of the complex in India (except *L. nilagirica*) and differs from the latter in having relatively shorter hind limbs, rounded digit tips and relatively larger metatarsal tubercles. A discriminant function analysis of eight morphological characters of *L. orissaensis* and *L. limnocharis* from India and the Malay Peninsula indicates distinct differences.

KEY WORDS.- Anura, Ranidae, *Limnonectes orissaensis*, new species, Orissa, India.

INTRODUCTION

Fifteen nominal species have been included in the *Limnonectes limnocharis* complex: *L. limnocharis, L. syhadrensis, L. brevipalmata, L. keralensis, L. murthii, L. nilagirica, L. sauriceps, L. mysorensis, L. nepalensis, L. pierrei, L. teraiensis, L. andamanensis, L. vittigera, L. greenii* and *L. kirtisinghei* (Dutta and Singh, 1996; Dutta, manuscript). The major diversification within the complex is centered in the Indian region- Nepal, India and Sri Lanka, where most of the species occur. In Sri Lanka, the complex is represented by three described species: *L. limnocharis, L. greenii* and *L. kirtisinghei* (Dutta and Manamendra-Arachchi, 1996). *L. brevipalmata* was described from southern India by Peters (1871). Annandale (1919) described *L. syhadrensis* from western India. Dubois (1975, 1984) described *L. pierrei, L. nepalensis* and *L. teraiensis* from Nepal; separating his species from *L. limnocharis* mainly on patterns of vocalization. Pillai (1979) described *L. murthii* from Tamil Nadu and the species resembles to *L. brevipalmata, L. greenii* and *L. limnocharis. L. keralensis* (replacement name for *Rana verrucosa*) was described from Kerala and the species is the largest among all the species included in the complex. *L. vittigera* was described from the Philippines by Boie in: Wiegmann (1835), although Inger (1954) considered it a subspecies of *L. limnocharis*. In a recent review of the *L. limnocharis* group, two subspecies, *L. l. nilagirica* and *L. l. andamanensis* have been given specific status by Dubois (1984). Further, he considered two species (*L. brevipalmata* and *L. sauriceps*) and one subspecies (*L. limnocharis mysorensis*) as with "uncertain status". However, Dutta and Singh (1996) considers them valid. Based on morphological similarities, the new species have been included within the *L. limnocharis* complex.

Field studies in Orissa, eastern India were conducted from 1976 to 1981 during which amplecting pairs of a new species were collected. Tadpoles were obtained from the eggs and reared in the laboratory. Comparative material examined are in Appendix I. Nomenclature follows Dubois (1992) and Dutta (1992) and museum abbreviations are as follows: AMNH, American Museum of Natural History, New York, USA; AMS, Australian Museum, Sydney, Australia; BMNH: Natural History Museum, London; CAS, California Academy of Sciences, San Francisco, USA; CAS-SU, California Academy of Sciences-Stanford Collection; CM, Carnegie Museum, Pittsburgh, USA; FMNH, Field Museum of Natural History, Chicago, USA; KU, University of Kansas, Museum of Natural History, USA; MCZ, Museum of Comparative Zoology, Cambridge, Massachusetts, USA; MNHN, Museum National d'Histoire Naturelle, Paris, France; NHMB, Naturhistorisches Mu-

seum, Basel, Switzerland; NMSL, National Museum of Sri Lanka, Colombo, Sri Lanka; SKD, S. K. Dutta Field Numbers; UMMZ, University of Michigan Museum of Zoology, Michigan, USA; USNM, United States National Museum, Smithsonian Institution, Washington, D. C., USA; WHT, Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka; and ZSI, Zoological Survey of India, Calcutta, India.

Limnonectes orissaensis sp. nov.
(Figures 1 — 4)

Holotype.- KU 197186, an adult female collected by S. K. Dutta from near a temporary rain water pool at Sainik School area, Bhubaneswar, Khurda District, Orissa India, 11 July 1980.

Measurements of holotype (in mm).- Snout-vent length (SVL) 46.5, snout to tympanum length 13.0, internarial distance 3.6, tympanum diameter 3.1, head length 16.8, head width 15.5, foot length 21.0, tibia length 22.4.

Paratypes (18 examples).- KU 197187-89, taken with the holotype; KU 197190-195; collected by S. K. Dutta from Bhubaneswar, Khurda District, Orissa, India, 4 July 1978; KU 197196-197, as above, 19 July 1980; SKD (Sushil K. Dutta) Field Nos. 2782, 2806, 2815, as above, 3 July 1980 (deposited at BMNH); SKD Field Nos. 402 (ZSI A8879); 404 (ZSI A8880); 406-407 (ZSI A8881-82), collected by S. K. Dutta from Rasulgarh area, Bhubaneswar, Khurda District, Orissa, India, 23 July, 1986.

Referred specimens (13 specimens).- KU 200439; collected by Dwight Platt from Barpali, Sambalpur District, Orissa, India, 27 July 1957; KU 200440; as above, 3 July 1957; KU 200441—200442; as above, 4 July 1957; KU 200443 and 200491; as above,17 July 1957; KU 200444; as above, 19 July ,1957; KU 200445-200447; as above, 4 September, 1957; KU 200448; as above, no date; KU 200490; as above, 27 June 1957; SKD Field No. 398 (ZSI A8884), collected by S. K. Dutta, from Kandarpur area, Cuttack District, 21 July, 1986.

Diagnosis.- *Limnonectes orissaensis* is a medium-sized ranid (males 36.2-47.2 mm; females 34.2-53.8 mm SVL) with interrupted longitudinal folds on dorsum, smooth venter, wider inner metatarsal tubercle, and a relatively more pointed

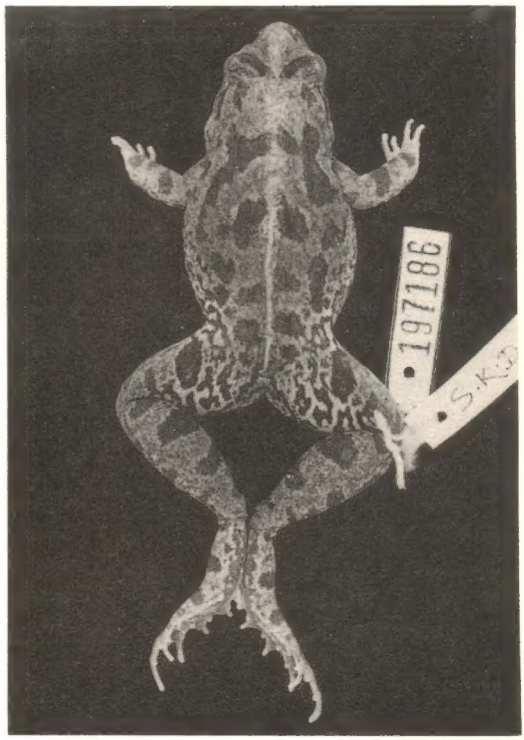

FIGURE 1: Holotype of *Limnonectes orissaensis* sp. nov. (KU 197186), adult female, SVL 46.5 mm

snout than closely related species, *L. limnocharis* from Vietnam, Taiwan, China and Japan. There is no size difference between *L. orissaensis* and *L. limnocharis* from the Malay Peninsula (Fig. 5), but a wider and longer inner metarsal tubercle (maximum length: 3.0 mm), greater number of ridges on dorsum, shorter hind limbs (maximum foot length: 24.3 mm), more rounded finger and toe tips and greater degree of webbing (fourth toe webbing extends less than half way between distal and penultimate subarticular tubercles) distinguishes *L. orissaensis* from *L. limnocharis* of the Malay Peninsula. *L. orissaensis* is easily distinguishable from the sympatric populations of *L. limnocharis* by its larger size. All species within the *L. limnocharis* complex in India and Sri Lanka are smaller in size than *L. orissaensis*, except *L. nilagirica* and *L. keralensis*. *L. niligirica*, however, has a relatively longer hind leg with pointed finger and toe tips, smaller inner metatarsal tubercle, and wider pigmented bars on lower jaw than *L. orissaensis*. *L. keralensis* is distinguishable by more extensive webbing

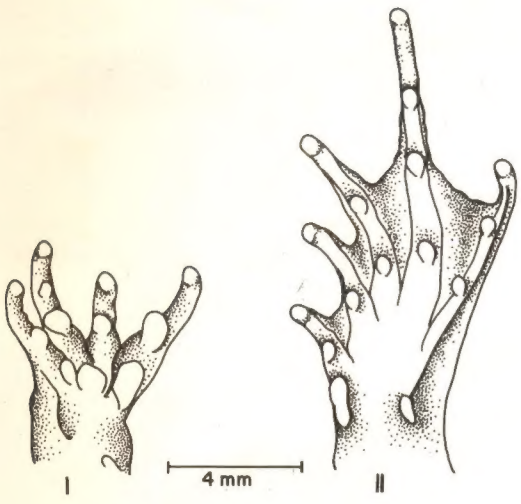

FIGURE 2: (I) Palmar view of the forelimb and (II) ventral view of hind limb of holotype of *Limnonectes orissaensis*.

(fourth toe webbing up to distal subarticular tubercle and others up to toe tips). All Nepalese endemics within the complex (*L. teraiensis, L. nepalensis* and *L. pierrei*) differ from *L. orissaensis* in having a relatively more tuberculate dorsum, semi-pointed finger and toe tips and reduced webbing (less than two-third).

Description.- SVL range 34.2-53.8 mm. Head longer than wide, depressed; snout pointed, extending beyond mouth; canthus rostralis obtuse; internarial distance more than interorbital width; loreal region slightly concave; narial openings dorsolateral. Tympanum distinct, rounded, diameter less than eye diameter, with supratympanic fold extending from posterior corner of eye to insertion of forelimbs. Vomerine teeth distinct, obliquely placed.

Finger and toe tips rounded, slightly swollen; first finger longer than second, third equal to, or slightly longer than first. Subarticular tubercles white, rounded, and larger than usually found in *L. limnocharis*; fingers not webbed. Hind limbs moderately long, with two metatarsal tubercles; inner metatarsal tubercle oval and larger than outer metatarsal tubercle. Longitudinal ridge extending from anterior border of outer metatarsal tubercle to tip of fifth toe. Subarticular tubercles rounded, similar to those on fingers. Webbing of

TABLE 1: Measurements of the type series of *Limnonectes orissaensis* sp. nov. Abbreviations: * = holotype; F = female; M = male.

Sl	Sex	SVL	ST	INW	DT	LLH	HW	FL	TL
1*	F	46.5	13.0	3.6	3.1	16.8	15.5	21.0	22.4
2	M	44.9	12.6	3.6	3.1	16.8	15.6	19.5	22.5
3	M	43.8	12.2	3.8	3.2	15.9	15.1	20.5	21.8
4	M	42.7	11.8	3.7	2.7	15.7	14.7	19.7	21.3
5	F	53.4	14.9	4.2	3.0	18.8	17.4	22.3	23.5
6	M	40.7	11.7	3.7	2.7	15.4	14.8	20.1	21.4
7	F	34.2	10.8	3.2	2.3	14.6	11.9	17.5	18.2
8	M	36.2	10.8	3.4	2.5	14.8	12.0	20.2	20.2
9	F	38.5	11.7	3.4	2.3	15.5	13.4	19.2	20.3
10	M	40.6	11.8	3.7	2.5	15.5	14.1	18.4	19.4
11	M	40.5	11.3	3.8	2.8	15.1	14.0	19.0	20.6
12	M	44.8	12.6	3.5	3.0	16.7	15.6	19.4	22.3
13	M	41.9	12.3	3.8	3.0	15.9	14.9	20.9	21.5
14	M	42.4	12.2	3.7	2.6	15.4	14.6	19.6	21.2
15	M	41.9	12.3	3.7	2.9	15.9	14.8	20.8	21.6
16	M	47.2	13.5	4.0	2.8	17.4	15.6	20.8	22.9
17	M	42.0	11.8	3.6	2.8	15.5	14.1	18.9	21.3
18	M	45.8	12.9	3.5	3.3	17.7	15.2	21.4	23.7
19	M	41.1	11.7	3.4	2.5	15.9	14.2	17.9	19.6
20	M	38.9	11.7	3.4	2.3	15.6	13.2	19.0	20.0
21	F	53.8	14.4	4.1	3.6	19.7	17.8	24.3	27.0
22	M	41.5	11.8	3.6	2.6	15.9	14.3	18.0	19.6
23	M	42.0	11.8	3.6	2.8	15.8	14.2	18.9	21.2
24	M	45.1	12.9	3.7	2.7	16.3	15.1	19.5	20.3
25	M	42.0	12.3	3.3	2.7	15.6	14.0	18.7	21.0
26	M	42.1	12.2	3.4	2.7	15.6	14.1	18.8	21.0
27	M	44.9	12.6	3.6	3.0	16.8	15.5	19.4	22.3

fourth extends less than half way between distal and penultimate subarticular tubercles; that on fifth toe extends beyond distal subarticular tubercle (Fig. 2). Skin on dorsum of head smooth, but body covered with interrupted, longitudinal ridges with small rounded ridges towards posterior border of body; skin on flanks and chin smooth; skin on belly and proximal ventral surfaces of thigh smooth.

Colour (in life).- Dorsum brown, grey or brick red; a V-shaped marking between eyes which is interrupted in specimens with a vertebral band; with or without yellowish narrow or wide vertebral band extending from tip of snout to vent, wide band if present, gradually narrows posteriorly; a >< shaped black patch on middle of body; limbs with complete or incomplete dark cross

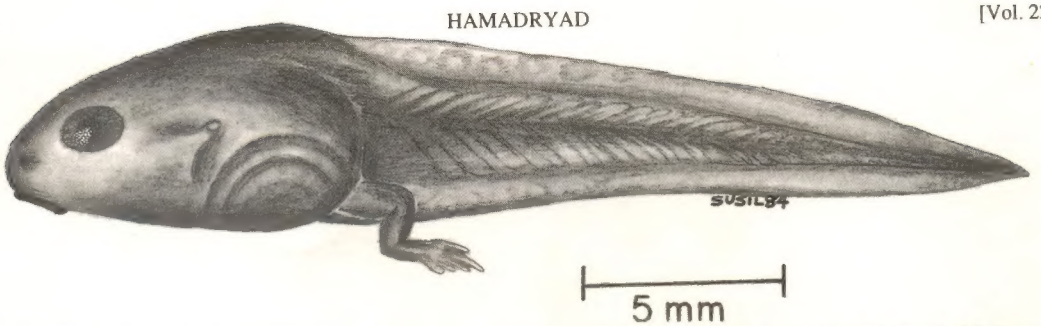

FIGURE 3: Tadpole of *Limnonectes orissaensis* (left side), Gosner's (1960) Stage 40, total length 30.6 mm.

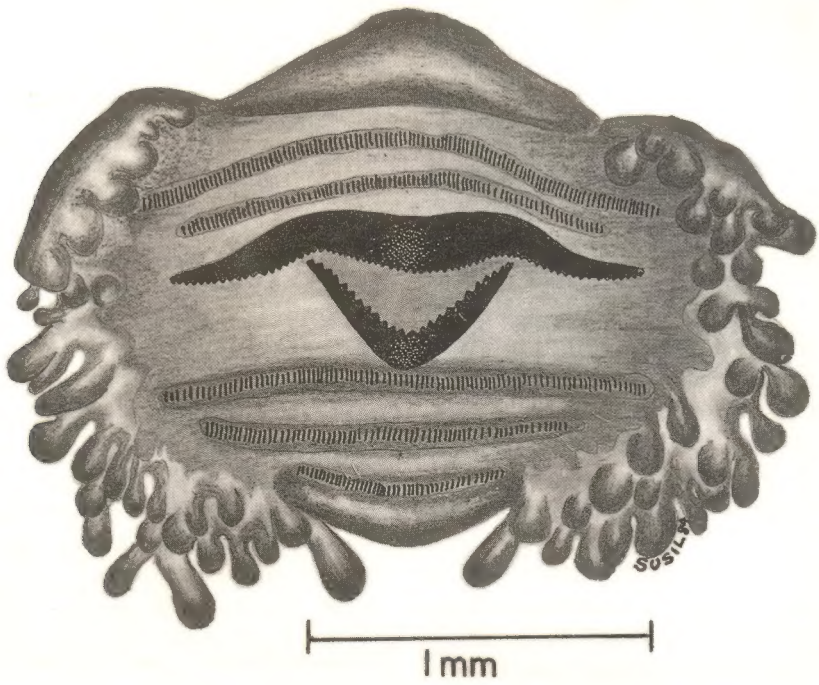

FIGURE 4: Mouth of tadpole of *Limnonectes orissaensis* showing keratinised teeth. Tooth row formula: 3/0/3.

bars; sides of thigh yellowish white with black speckles; jaw margins with black vertical bars.

Tadpole description.- The larval stages described here were reared in the laboratory. A tadpole at developmental stage 40 (Gosner, 1960) is 30.6 mm from tip of snout to tip of tail; body ovoid; snout bluntly rounded in dorsal view; eyes moderately small, dorsolaterally placed; sinistral spiracle projected slightly upward; caudal musculature robust, extending to tip of tail; well-developed tail fins, dorsal and ventral fins equal; tail tip acute; fins lightly pigmented with scattered black pigmentation throughout (Fig. 3).

Oral disc ventral, not modified as a sucker; prominent oral papillae, with rostral and ventral gaps; marginal papillae in a single row laterally and multiple row ventrally; upper beak in one piece, wider than high; margin medially convex, with triangular and acute serrations, completely keratinized. Lower beak V- shaped, larger serrations, other character same as upper beak. Two upper and three lower rows of denticles, uninterrupted; upper rows long, second upper row slightly shorter than first; lower rows similar to upper ones with third row shortest (Fig. 4).

Morphometric analysis.- Eight morphological characters were measured on 67 preserved

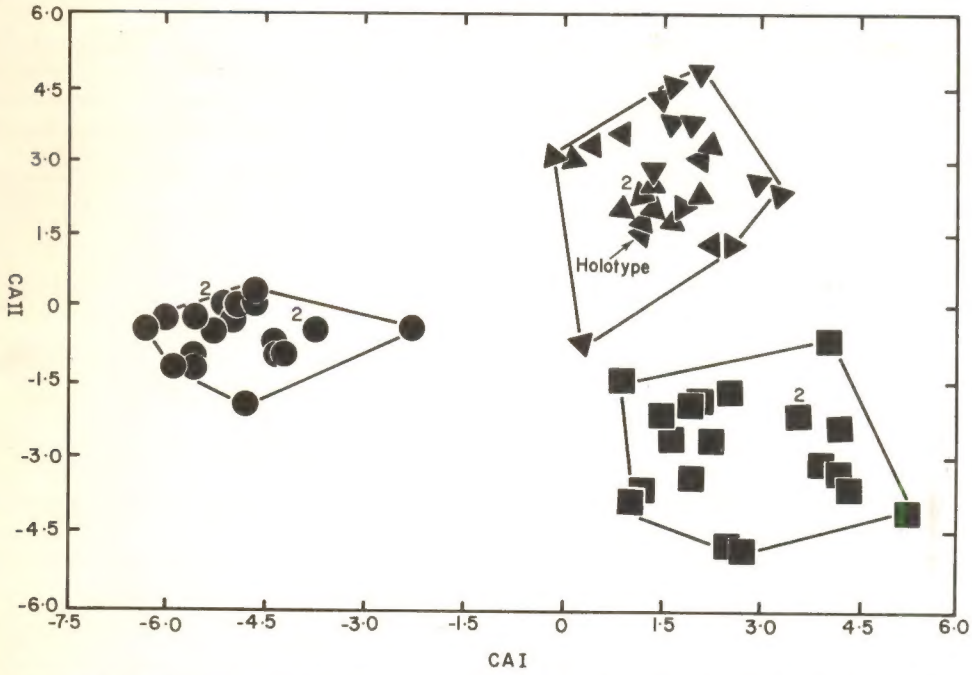

FIGURE 5: Plot of scores of individuals of *Limnonectes limnocharis* from the Malay Peninsula (squares; n = 20), from Orissa, India (circles; n = 20) and *L. orissaensis* (triangles; n = 27) on canonical axes I and II. See text for identification of canonical variables.

adults : (1) SVL, (2) snout to tympanum length, (3) internarial width, (4) horizontal tympanum diameter, (5) lateral length of head from tip of snout to corner of mouth, (6) head width between tympani, (7) length of fourth toe from tip of toe to base of inner metarsal tubercle, and (8) tibiofibula length from middle of joint at each end. All measurements were rounded to the nearest 0.1 mm.

A discriminant function analysis (BMDP 7M; Dixon *et al.*, 1981) was performed on the measurements. Two populations of *L. limnocharis*, one from the Malay Peninsula and the other from Orissa, India, sympatric with the new species, were included in the analysis along with the new species. The program was stopped when the F's-to-remove of all variables were above the 0.05 level of significance. In the discriminant function analysis, six variables were selected by the program as having significant F,s-to-enter: snout-vent length (X1), internarial width (X2), lateral length of head from tip of snout to corner of mouth (X3), head width between tympani (X4), length of fourth toe from tip of toe to base of inner metatarsal tubercle (X5), and tibiofibula length from middle of joint at each end (X6). The canonical analysis produced two new variables that are plotted along canonical axes I and II (Fig. 5). These two canonical variables have been defined by the following equations:

CV I = -0.457 (X1), +2.036 (X2), + 1.026 (X3), + 1.181 (X4), + 0.237 (X5), -0.522 (X6), -13.631.

CV II = -0.217 (X1), + 1.371 (X2), + 0.676 (X3), -1.670 (X5), + 0.839 (X6), + 0.567.

Representatives of the two populations of *Limnonectes limnocharis* and the new species measured in the analysis represent three distinct groups along the two canonical axes (Fig. 5). There is no overlap between the groups, and populations of *L. limnocharis* from the Malay Peninsula is separated primarily along the second canonical axis. *L. limnocharis* from Orissa is separated from the Malay population and the new species along the first canonical axis.

Distribution and ecology.- The new species has been collected from Jaleswar (Balasore District), Barpali (Sambalpur District) and Bhubaneswar (Khurda District). Most specimens were collected during the monsoons, June to

July. They were found close to human habitations, on grassy lands near water pools, and near paddy fields. When disturbed, they jumped into water, but immediately returned to the edges. *Limnonectes orissaensis* can be distinguished from *L. limnocharis* by its distinct call. Males of *L. limnocharis* call uninterruptedly for hours, producing calls typical of crickets (*Gryllid* sp.). However, calls of *L. orissaensis* males are not cricket-like and the call frequency is lower than in *L. limnocharis*. *L. orissaensis* is active at night and hides in grass, below rocks, or in small holes near water during the day. Eggs are laid in open temporary rain water pools; the larvae are free-swimming and are morphologically similar to *L. limnocharis* tadpoles except for their larger size.

Etymology.- Latin for inhabitant of Orissa.

COMPARISONS

Limnonectes orissaensis is closely related to *L. limnocharis* populations from the Malay Peninsula, but morphologically distinct from both the Indian and other Asian *L. limnocharis* examined. Of the 15 species within the complex, the only Indian endemic, *L. nilagirica* of southern India, can be confused with the new species, but as has been pointed out by Boulenger (1920), *L. nilagirica* has longer hind limbs than *L. limnocharis*. *L. orissaensis* also has less webbing than *L. nilagirica*. Another larger Indian species, *L. keralensis*, with a maximun SVL of 59.8 mm is distinguishable from the new species by more webbing between toes (fourth toe webbing to distal subarticular tubercle and others up to toe tips), verrucose dorsum and tubercular orbit.

The remaining species within the *Limnonectes limnocharis* complex from the Indian region are distinguished from *L. orissaensis* by their smaller size. Because *L. orissaensis* is larger than the sympatric *L. limnocharis*, and on account of its vertebral bands, Mohanty-Hejmadi (1974) confused *L. orissaensis* with *Hoplobatrachus tigerinus*, although there is otherwise little similarity between these two species. *Limnonectes murthii*, described from Tamil Nadu, is smaller (maximum snout-vent length 35.0 mm) compared to *L. orissaensis*. In addition, *L. murthii* bears resemblace with *L. limnocharis*, *L. brevipalmata* and *L. greenii*, but the males of *L. murthii* bear a pair of patches with papillae on the breast (Pillai, 1979). No such patch with papillae is seen in *L. orissaensis*. *L. brevipalmata*, with a maximum SVL of 47.0 mm is distinguishable from the new species in possessing a shovel-shaped inner metatarsal tubercle and pointed finger and toe tips. *L. syhadrensis* is a dimunitive species and the tubercular dorsum, less extensive webbing, pointed finger and toe tips, pointed snout and minute metatarsal tubercles differentiate the species from *L. orissaensis*. *Limnonectes mysorensis* is distinguishable from the new species by larger, elongated and laterally compressed inner metatarsal tubercle, pointed finger and toe tips and blotched lower lip. It has not been possible to examine *L. andamanensis*, but according to the original description, the

TABLE 2: Snout-vent length (SVL) and foot length (FL) of species included in the *Limnonectes limnocharis* complex. Abbreviations: * measurement not taken. Number of specimens examined in parentheses in SVL column.

SPECIES	SVL (range in mm)	FL (range in mm)
L. andamanensis	Not examined	
L. brevipalmata	21.2-47.0 (16)	12.9-32.0
L. greenii (Manamendra-Arachchi and Gabadage, 1996)	35.0-39.1 (8)*	
L. keralensis	28.3-59.8 (24)	16.1-34.6
L. kirtisinghei (Manamendra-Arachchi and Gabadage, 1996)	25.9-40.8 (9)	*
L. limnocharis (from India)	21.8-38.1 (25)	12.8-19.5
L. nepalensis	30.0-40.0 (10)	16.8-27.0
L. murthii	35.0 (holotype)	*
L. mysorensis	37.0 (holotype)	25.8
L. nilagirica	32.6-52.8 (28)	18.3-30.5
L. orissaensis	34.2-53.8 (27)	18.5-24.3
L. pierrei	31.3-46.0 (10)	17.5-30.5
L. sauriceps	30.0 (holotype)	*
L. syhadrensis (from Nepal)	28.6-38.9(9)	*
(from Bombay; Boulenger, 1920)	27.0-31.5 (2)	*
L. teraiensis	42.6-60.6 (10)	22.0-35.0
L. Vittigera	40.2-90.7(31)	21.2-48.7

species is distinct in its colouration (chestnut brown) which is not seen in *L. orissaensis*.

The new species differs from *Limonnectes greenii* and *L. kirtisinghei* (both endemic to Sri Lanka) in the absence of uninterrupted longitudinal stripes on the dorsum, larger SVL, elongated inner metatarsal tubercle and rounded finger and toe tips.

Of the three Nepalese endemics in the complex, *Limnonectes teraiensis* with a maximum SVL of 60.6 mm (greater than the new species) and the densely tubercular dorsum and more webbing on the toes (greater than two third) differentiate the species from *L. orissaensis*. The remaining two members of the complex, *L. nepalensis* and *L. pierrei* have been described based only on variations in call pattern (Dubois, 1975), which are different from that of *L. orissaensis* (Dutta: manuscript). In addition, the webbing between the toes is similar to *L. teraiensis* in both the species.

ACKNOWLEDGEMENTS

This research has been partly supported by K. P. Schmidt Travel Fund of the FMNH, Chicago, and travel grants from the CM, Pittsburgh and CAS, San Francisco. For loans of specimen, I thank Barry T. Clarke, BMNH; Robert C. Drewes and Jens V. Vindum, CAS; Alan Dubois, MNHN; Robert F. Inger, FMNH; and Ellen J. Censky, CM. I am grateful to Dwight Platt, Newton College, Kansas for allowing me to examine some of his collections and William E. Duellman, Linda Trueb, Darrel Frost, David Cannatella and Robert F. Inger for reading the manuscript and providing suggestions. Thanks are also due to an annonymous referee for improvement of the text.

LITERATURE CITED

ANNANDALE, N. 1919. The fauna of certain small streams in the Bombay Presidency: IV. Some frogs from streams in the Bombay Presidency. *Rec. Indian Mus.* 16: 121-125.

BOULENGER, G. A. 1904. Description of a frog from Ceylon, hitherto confounded with *Rana limnocharis*. *Spolia Zeylanica* 2: 73-74.

_____. 1920. A monograph of the South Asian, Papuan, Melanesian and Australian frogs of the genus *Rana*. *Rec. Indian Mus.* 20: 28-34.

DIXON, W. J., M. B. BROWN, L. ENGELMAN, J. W. FRANE, M. A. HILL, R. I. JENNRICH & J. D. TOPOREK. 1981. BMDP statistical software 1981. University of California Press, Berkeley.

DUBOIS, A. 1975. Un nouveau complex d'especes jumelles distinguees par le chant: les grenouilles du Nepal voisines de *Rana limnocharis* Boie (Amphibiens: Anoures). *C. R. Acad. Sci., Paris, Ser. D.* 281: 1717-1720.

_____. 1981. Deux noms d'especes preoccupes dans le genre *Rana* (Amphibiens, Anoures). *Bull. Mus. Nat. Hist.*, Paris 4(2A): 927-931.

_____. 1984. Note preliminaire sur le groupe de *Rana limnocharis* Gravenhorst, 1829 (Amphibien Anoures). *Alytes* 3(4): 143-159.

_____. 1992. Notes sur la classification des Ranidae (Amphibiens: Anoures). *Bull. Mens. Soc. Linn. Lyon* 61(10): 305-353.

DUTTA, S. K. 1992. Amphibians of India: updated species list with distribution record. *Hamadryad* 17: 1-13.

_____. & N. SINGH. 1996. Status of *Limnonectes limnocharis* (Anura: Ranidae) species complex in Asia. *Zoos' Print* 11(8): 15 and 21.

GOSNER, K. L. 1960. A simplified method of staging anuran embryos and larvae with notes on identification. *Herpetologica* 16: 183-190.

INGER, R. F. 1954. Systematics and zoogeography of Philippine Amphibia. *Fieldiana: Zool.* 33: 183-531.

JERDON, T. C. 1853. Catalogue of reptiles inhabiting the Peninsula of India. *J. Asiatic Soc. Bengal* 22: 522-534.

MANAMENDRA-ARACHCHI, K. & D. GABADAGE. 1996. *Limnonectes kirtisinghei*, a new species of ranid frog from Sri Lanka. *J. south Asian nat. Hist.* 2(1): 31-42.

MOHANTY-HEJMADI, P. 1974. Amphibian fauna of Orissa. *Prakruti- Utkal Univ. J. Sci.* 11: 89- 97.

PETERS, W. 1871. Neue Gattungen und neue oder Weniger bekannte Arten von Amphibien. *Monatasber Akad. Wiss. Berlin* 1871: 646.

PILLAI, R. S. 1979. A new species of *Rana* (family: Ranidae) from Western Ghats, S. India. *Bull. Zool. Surv. India* 2(1): 39-42.

RAO, C. R. N. 1922. Notes on batrachian. *J. Bombay nat. Hist. Soc.* 28:439-447.

_____ . 1937. On some new forms of Batrachia from south India. *Proc. Indian Acad. Sci.* B6: 387-427; Pl. XXI - XXXI.

ROY, D. 1994. Development of hearing in vertebrates with special reference to anuran acoustic communication. *J. Biosci.* 19(5): 629-644.

_____ & A. ELEPFANDT. 1993. Bioacoustic analysis of frog calls from northeast India. *J. Biosci.* 18: 381-393.

STOLICZKA, F. 1868. Observations on some Indian and Malayan Amphibia and Reptilia. *J. Asiatic Soc. Bengal* 39: 134:228.

WIEGMANN, A. F. A. 1835. Beitrage zur Zoologie, gessamelt, auf einer Reise um die Erde, von Dr. F. J. F. Meyen. Siebente Abhandlung: Amphibien. *Nova Acta Acad. Leop. Carol., Halle* 17: 185-268.

APPENDIX I

COMPARATIVE MATERIALS EXAMINED

Limnonectes brevipalmata: India: Kotegehar (FMNH 172575-79; 172774; 174019; 174021; 174096-99; 174101; 174103); Mysore: South Canara: Someshwar (CAS 104206).

Limnonectes greenii: Sri Lanka: No further locality: FMNH 81228; NHMB 7504; CAS 85275-76; 38821; MCZ 10155; 15361 (syntype of *Rana greenii*); Uva Province: Ella: CM 67682-83; Central Province: Nanú Oya: FMNH 131317-49; Kubalgamuwa: CM 67757-58; 8 miles south-west of Nuwara-Eliya: Hakgala Botanical Garden: CAS 141789-90; Horton Plains: AMNH 74201; 74220; Kandapola: AMNH 76994-96; Sinharaja: AMNH 77485-89; Kandy District: Udawatta Kale: CM 89938; Western Province, 10 miles north of Puttalam: AMNH 74260-61; 117712-13; Nagrak Division, Nonpareil Estate (adjoining Horton Plains): WHT 0437 (8 specimens); Hakgala (near Nuwara Eliya): WHT 01129 (3 specimens); Nuwara Eliya: WHT 01128.

Limnonectes keralensis: India: Kerala: Cochin: Parambikulam (USNM 66966-67); Trivandrum District: Ponmudi (FMNH 217985-8003; 218472-73; CAS 15390-93); Anaimalai Hills: Valparai: Sevamallai (FMNH 40524-26; CAS-SU 7246-49); Travancore: Kallai, 30 miles north-east of Trivandrum (CAS-SU 7243-45); Karadikkavala, Periyar Wildlife Sanctuary (UMMZ 172910).

Limnonectes kirtisinghei: Sri Lanka: Moray Estate, Rajamally, near Mousakelle, alt. 1370 m (AMS R 148272: holotype); Paratypes: Namunukula Group near Passara (AMS R 148276); Koskulana near Panapola, Sinharaja (AMS R 148273-75); Kumaradola Group (Moneragala) (WHT 01117); Bambarakanda, Kalupahana (near Belihul Oya) (WHT 0808); Silverkanda (Deniyaya) (WHT 0919); Laggala (Knuckles) (NMSL AR 13a); Morningside (near Rakwana) (NMSL AR 13b); Bulutota (WHT 01017); Kanneliya (Galle) (WHT 01116); Kotagala (WHT 01118); Parawalatenna (Kitulgala) (WHT 01126); Ramboda (WHT 01127); Opata, Kanneliya Forest, Galle (WHT 01130).

Limnonectes limnocharis: China: Szechuan (FMNH 16832, 55 specimens). Malaysia: Sarawak: 2nd Division (CM 62844-63); Sarawak: First Division (CM 62864-65; FMNH 121859-60); Kuala Lumpur (FMNH 125661); Perak (FMNH 173686-90; 186489-90; 186492-95; 186497-99); 186501; 186503-05; 186508-13; 186515; 186518-19; 185520-21). Vietnam: Tay Ninh Province (CM 47452-55). Thailand: Nakhon Phanom Province (CM 50092-112). Japan: Okinawa Shima: Riu Kiu Island (CM 25937-39; 25941; 46229; 46502-504; 47230-32; 47471; 45844). Taiwan: 8 miles north Hua- Lien (FMNH 169218; 169226-33); Pei Tou: 8 miles north of Taipei (FMNH 82428-29; 82432-41; 82444-45); Yung Foh Lee: north slope grass mountain (FMNH 82115). India: Orissa: Balasore: Bhadrak (KU 193684-719); Orissa: Bhubaneswar (KU 193720-56); Madhya Pradesh: Balaghat district (FMNH 60675-85); Assam (FMNH 72408-409; 72411; 134794).

Limnonectes mysorensis: India : Mysore (BMNH 1921.1.20.2, holotype).

Limnonectes nepalensis: Central Nepal: Godavari (MNHN 1975. 1610; 1975. 1613; 1975. 1619-20; 1975. 1662-63; 1975. 1666-68).

Limnonectes nilagirica: India: Nilgiris (BMNH 67.8.11.8); Malabar (BMNH 74.4.29.678).

Limnonectes pierrei: Nepal: Tarhara (MNHN 1975. 1746; 1975. 1748; 1975. 1751;1975. 1754-57; 1975. 1760-62, paratypes).

Limnonectes syhadrensis: India: ZSI 19764 (holotype); Bihar: Ranchi (CAS 94522-30); Uttar Pradesh: Moradabad (CAS 102944-47); Bombay (CAS 101516).

Limnonectes teraiensis: Nepal: Tarhara (MNHN 1976.1069; 1071-72; 1076; 1078; 1081; 1083-84; 1086; 1088).

Accepted: 29 April, 1997.

Hamadryad, Vol. 22, No. 1, pp. 9 – 12, 1997.

A NEW FROG OF THE GENUS *NYCTIBATRACHUS* (ANURA: RANIDAE) FROM SOUTHERN INDIA

M. S. Ravichandran

Zoological Survey of India, Southern Regional Station, 100, Santhome High Road, Chennai 600 028, India
(with one text figure)

ABSTRACT.- A new species of *Nyctibatrachus* is described from the Kalakad Tiger Reserve, Tamil Nadu, southern India. The new species is diagnosed by the following characters: canthus rostralis and tympanum indistinct; interorbital space wider than the upper eyelid; tongue short, lacking a papilla; vomerine teeth present; skin smooth; fingers free; toes webbed to the base of disks; and digital disks present. The new species is compared with known congeneric species, including species formerly assigned to the genus *Nannobatrachus*.

KEY WORDS.- Anura, Ranidae, *Nyctibatrachus vasanthi*, new species, Kalakad Tiger Reserve, India.

INTRODUCTION

The ranid genus *Nyctibatrachus* Boulenger, 1882, is represented by 10 nominal species (see Inger and Dutta, 1986; Dubois, 1992; Shaffer, 1988), which are confined to the Western Ghats forests of south-western India. Shaffer (1988) showed *Nannobatrachus* Boulenger, 1882 to be synonymous with *Nyctibatrachus*, based on body size-scaling patterns. Species considered valid within this assemblage include *N. aliciae* Inger, Shaffer, Koshy and Bakde, 1984; *N. beddomii* (Boulenger, 1882), *N. kempholeyensis* (Rao, 1937), *N. deccanensis* Dubois, 1984; *N. humayuni* Bhaduri and Kripalani, 1955, *N. modestus* Rao, 1920, *N. major* Boulenger, 1882, *N. minor* Inger, Shaffer, Koshy and Bakde, 1984, *N. sanctipalustris* Rao, 1920, and *N. sylvaticus* Rao, 1937.

During surveys on the eastern slopes of the Kalakad Tiger Reserve (08° 25-35' N; 77° 25 35'E), Tamil Nadu, southern India, three specimens of a hitherto undescribed species of *Nyctibatrachus* were found, and are being described here.

MATERIALS AND METHODS

Measurements were taken with dial vernier calipers of specimens that were fixed in formalin and preserved in ethanol. Comparisons of the new species have been made with the types and non-types of *Nyctibatrachus aliciae* and *N. minor*, as well as non-type of *N. deccanensis*, *N. major* and *N. santipalustris*, in addition to data in Inger *et. al.* (1984). The types of *N. kempholeyensis* and *N. sylvaticus* (see Frost, 1985) are lost, and the species has not been collected subsequent to its original description, and comparisons have been made with the original description provided by Rao (1937). The type series of the new species has been deposited in the Zoological Survey of India, Southern Regional Station (ZSI/SRS), Madras, India. Comparative material examined are in Appendix I. Sex was verified through examination of the gonads.

Nyctibatrachus vasanthi sp. nov.

(Figure 1)

Holotype.- ZSI/SRS VA 1074 (adult male). Solaipalam Aru (Kakachi), Kalakad Tiger Reserve, Tirunelveli District, Tamil Nadu, south India, altitude ca. 1,120 m above msl. Collected by M. Vasanth. 11 September, 1985.

Paratypes.- ZSI/SRS VA 1075 (adult male). Solaipalam Aru (Kakachi), Kalakad Tiger Reserve, Tirunelveli District, Tamil Nadu, south India, altitude ca. 1,120 m above msl. Collected by M. Vasanth. 11 September, 1985; ZSI/SRS VA 1076 (immature male). Kuvapati Odai, near Sengaltheri, Kalakad Tiger Reserve, Tirunelveli District, Tamil Nadu, south India, altitude ca. 800

m above msl. Collected by M. Vasanth. 24 April, 1987.

Diagnosis.- A medium-sized species of *Nyctibatrachus*, differing from congeneric species in showing the following characters: canthus rostralis and tympanum indistinct; interorbital space lacking a papilla; vomerine teeth present; skin smooth; fingers free; toes webbed to the base of disks; and digital disks present.

Description (based on the type series).- Head depressed, broader than long; snout blunt, nearly as long as the diameter of eye; head width (at angle of jaws) greater than twice distance from tip of snout to anterior corner of eye; canthus rostralis indistinct; loreal region somewhat concave; nostril opening dorsally oriented and elevated; interorbital space as broad as or a little broader than upper eyelid; tympanum indistinct; pupil elliptical or rhomboidal; vomerine teeth prominent, the series oval, set close to one another, and located behind the choanae; tongue short, free bifid, and devoid of papilla.

Forelimbs short; fingers free, their tips dilated into small disks that lack circummarginal grooves; first finger shorter than second; subarticular tubercles indistinct.

Hind limbs stout, tibia relatively long (tibia length/snout-vent length ratios 0.506-0.817; toe webbing reaches base of disks, which show narrow circummarginal grooves; outer metatarsal tubercle separated by webbing up to the base; subarticular tubercles prominent; inner metatarsal tubercle narrow and elongate.

Skin of body loosely connected to underlying tissue. Mid-dorsal region, from eye to groin, without wrinkles. Flanks with short folds; a faint glandular ridge present, which extends from tip of snout, bifurcating between nostrils and ending at the level of anterior corner of each eye. Upper eyelid with three or four longitudinal folds. Supratympanic fold weak. Skin of belly and throat smooth.

Colour (in life).- Dorsum light tan with irregular dark brown blotches. A narrow dark brown band is present between the eyes. Margin of upper eyelid black. A yellowish oval blotch is present near the anterior corner of eye. Limbs with brown cross-bars. Ventrally dull yellow.

FIGURE 1: Holotype of *Nyctibarachus vasanthi* sp. nov. (ZSI/SRS VA 1074.) Marker = 10 mm.

TABLE 1: Measurements (in mm) on the type series of *Nyctibatrachus vasanthi* sp. nov. (see text for details.)

	ZSI/SRS VA 1074	ZSI/SRS VA 1075	ZSI/SRS VA 1076
Snout-vent length	23.5	26.1	35.6
Axilla-groin distance	7.4	12.2	12.4
Head Length	8.3	8.4	12.1
Head width	10.2	9.9	15.1
Head depth	5.6	4.8	9.2
Eye diameter	3.5	3.4	5.2
Upper eyelid width	1.8	1.5	2.4
Interorbital distance	4.1	3.9	4.5
Internarial distance	3.0	2.9	4.1
Eye-snout-tip distance	3.7	4.2	5.9
Eye-nostril distance	2.2	1.9	3.3
Tibia length	11.9	12.5	12.1

Sexual dimorphism.- The holotype, an adult male, shows a pair of oval, cream-coloured femoral glands that extend from the base of the femur to about a third its length. In addition, it is smaller (SVL 23.5 mm) than the only adult female known (SVL 35.6 mm).

Etymology.- For M. Vasanth of ZSI with whom I have spent many days exploring forests and collecting both amphibians and gryllids.

TABLE 2: Measurements (in mm) on fingers and toes of the type series of *Nyctibatrachus vasanthi* sp. nov.

	Fingers				Toes				
	1	2	3	4	1	2	3	4	5
ZSI/SRS 1074	2.5	4.4	5.4	4.9	3.9	6.1	8.8	8.5+	7.9
ZSI/SRS 1075	1.7	4.2	5.8	5.3	4.4	6.7	9.4	11.3	8.8
ZSI/SRS 1076	3.6	6.2	9.0	7.4	6.5	8.4	14.0	16.4	11.8

Natural history notes.- The holotype and one paratype of *Nyctibatrachus vasanthi* were collected on the banks of the Solaipalam River (Kakachi), which connects Manjolai Estate with Malumukku, while the second paratype was taken from near Sengaltheri Forest Rest House, on the edges of Kuvapatti Odai, a small hill stream. They were found below rocks in the edges of water, to which they leapt into, when the rocks were overturned. One of the paratypes contains ova, suggesting the release of eggs during the northeast monsoons (November-December). In the same area, *N. aliciae*, *N. deccanensis* and *N. major* were also taken (Ravichandran, 1996).

COMPARISONS

The completely webbed feet separates *Nyctibatrachus vasanthi* from all its congeners. It additionally differs from *N. sylvaticus* in showing extensive toe webbing (vs "more than half-webbed"), absence (vs presence) of a canthus rostralis, and head wider than long (vs longer than, or as long as wide). It differs from *N. aliciae* in having extensive webbing on the foot (vs webbing not reaching the base of disks), fingers without (vs with) circummarginal grooves, presence (vs absence) of skin folds, and an ill-defined (vs well defined) supratympanic fold. It can be separated from *N. deccanensis* which shows half webbed feet, an oblique fold beneath eyes (vs absent) and large femoral glands. From *N. humayuni*, the new species can be separated as being smaller, finger tips not as expanded and greater toe webbing (reduced in *N. humayuni*). *N. major* (redescribed by Pillai, 1978) is easily separable from the new species in being larger (SVL 55 mm), with toes three-fourths webbed. The rudimentary webbing small body size (SVL 21.0 mm) and presence of the characteristic 'X'-shaped mark on the anterior half of the dorsum puts *N. minor* apart from the new species. Unlike *N. vasanthi*, *N. santipalustris* shows half webbed toes.

From both *Nyctibatrachus beddomii* and *N. kempholeyensis*, the new species can be differentiated in its larger size and more extensive webbing on toe (vs toes with rudimentary webbing on toe (vs toes with rudimentary webbing that fail to reach basal tubercle). *N. beddomii* is a small species, reaching 20.0 mm and is further differentiated in showing a light band on each side of the back.

ACKNOWLEDGEMENTS

I thank J. R. B. Alfred, Acting Director ZSI, and P. T. Cherian, Officer-in-Charge, ZSI/SRS for facilities and M. Vasanth for collecting the type series of the new species. The Director, National Musum of Natural History (NMNH), New Delhi permitted the examination of comparative material.

LITERATURE CITED

BOULENGER, G. A. 1882. Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum. Second edition. British Museum, London. Reprinted 1966, Weldon & Wesley, Ltd., Codicote and J. Cramer, Lehre. xvi + 503 pp + Pl. I-XXX.

DUBOIS, A. 1992. Notes sur la classification des Ranidae (Amphibiens Anoures), *Alytes* 61 (10): 305-352.

FROST, D. R. (Ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc. and Association of Systematics Collections, Lawrence. v + 732 pp.

INGER, R. F. & S. K. DUTTA. 1986. An overview of the amphibian fauna of India. *J. Bombay nat. Hist. Soc.* 83 (suppl.): 135-146.

_____ , H. B. SHAFFER, M. KOSHY & R. BAKDE. 1984. A report on a collection of amphibians and reptiles from the Ponmudi, Kerala, south India. *J. Bombay nat. Hist. Soc.* 81: 406-427.

PILLAI, R. S. 1978. On *Nyctibatrachus major* Boul. (Ranidae) with a description of its tadpole. *Bull. Zool. Surv. India* 1(2):35-140.

RAO, C. R. N. 1937. On some forms of Batrachia from S. India. *Proc. Indian Acad. Sci.* B6: 387-427; Pl. XXI - XXXI.

RAVICHANDRAN, M. S. 1996. Amphibia of the Kalakad Wildlife Sanctuary, Tamil Nadu, India. *Cobra* 23: 15-31.

SHAFFER, H. B. 1988. Size and scaling in the Indian frogs *Nyctibatrachus* and *Nannobatrachus* (Ranidae). *Fieldiana Zool. n.s.* (46): 1-10.

APPENDIX I

Nyctibatrachus aliciae: NMNH unregistered (holotype [field number: RFI 3130] and 13 paratypes of *Nyctibatrachus aliciae* Inger *et. al.*, 1984), "Ponmudi, Trivandrum District, Kerala, 350 m elevation"; ZSI/SRS VA 768, 788, 817, Kalakad Tiger Reserve, Tamil Nadu.

Nyctibatrachus beddomii: ZSI/SRS VA 440, Sabarigiri, Kerala; ZSI/SRS VA 475, 508, 55, Silent Valley, Kerala; ZSI/SRS VA 615, Anaimalai, Tamil Nadu; ZSI/SRS VA 630, Valparai, Tamil Nadu.

Nyctibatrachus deccanensis: ZSI/SRS VA 616, Siruvana Forest, Coimbatore, Tamil Nadu, ZSI/SRS VA 910, 921, 926, 1001, Kalakad Tiger Reserve, Tamil Nadu.

Nyctibatrachus major: ZS/SRS VA 61, Manantoddy, Kerala; ZSI/SRS VA 84, 94, 113, Chedleth, Kerala ; ZSI/SRS VA 242, Karadi Kavala, Kerala; ZSI/SRS VA 412, 417, Sabarigiri, Kerala; ZSI/SRS VA 467, 484, 491, Silent Valley, Kerala.

Nyctibatrachus minor: NMNH unregistered (holotype [field number: RFI 31175] and 14 paratypes of *Nyctibatrachus minor* Inger *et al.*, 1984), "Ponmudi, Trivandrum District, Kerala, at 350 m elevation".

Accepted: 1 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 13 – 20, 1997.

RESOLUTION OF THE SYSTEMATIC STATUS OF *EUBLEPHARIS MACULARIUS FUSCUS* BÖRNER, 1981 (EUBLEPHARIDAE: SAURIA: SQUAMATA)

Indraneil Das

Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India
(with three text figures)

ABSTRACT.- The disjunct population of leopard geckos, genus *Eublepharis* from western India (Gujarat, Maharashtra and Karnataka) is shown to be non conspecific with *E. macularius*. Originally described as a subspecies of *E. macularius* by Börner (1981), *E. fuscus* is demonstrated to be both diagnosable and allopatric with congeners, and therefore elevated to species status and a neotype designated. *Eublepharis fuscus* differs from known congeners in possessing the following combination of characters: six postnasals contacting nasals; eight supralabials to a point below pupil; mental small, hexagonal, longer than wide and about twice as long as the first pair of postmentals; prefrontal region with smooth, flat scales; large granular and non-spinose tubercles on the dorsum; tubercles smaller than intertubercular regions; 42 mid-body scale rows across belly to below lateral row of tubercles; 10-11 preanal pores; femoral pores absent; subdigital scansors entire, smooth; toe IV exceeding toe III in length, a single broad pale dorsal band between the nuchal loop and caudal constriction and maximum SVL recorded: 252.0 mm.

KEY WORDS.- Sauria, Eublepharidae, neotype designation, *Eublepharis fuscus*, *Eublepharis macularius*, India.

INTRODUCTION

The western Indian leopard gecko, *Eublepharis macularius*, was known to have a disjunct distribution (Grismer, 1988: Fig. 44), the range of the species encompassing western India, including the states of Maharashtra and Gujarat, and after a discontinuity of circa 400 km, north to Pakistan, the plains of northern India, southern and eastern Afghanistan. In his account of the material in the collection of the BMNH, Boulenger (1885) gave the distribution of the species as "north-western India, probably ranging through Baluchistan and Persia to the Euphrates", and did not fail to notice that an example from "Kandesh" (= Khandesh, in Maharashtra State, India) had two broad dorsal bands (the midbody band and the band at caudal constriction), similar to the pattern known in *Eublepharis hardwickii*, while at the same time showing the variegations of the double-banded *E. macularius*.

An examination of material collected from several localities in south-western India and a comparison with forms taken from the localities in the northern parts of the range, indicate subtle but consistent differences in morphological features of the two groups of eublepharid geckos hitherto referred to as *Eublepharis macularius*. Since Blyth's (1854) type of the taxon came from "Salt Range, Punjab" (now in Pakistan) in the north, the western population is not conspecific. A name published in a privately published journal (*Saurologica*), but available in the sense of Article 13 of the International Code of Zoological Nomenclature, Third Edition (Ride *et a* 1985), is shown to be available for the popul tion.

MATERIALS AND METHODS

The following measurements were taken with dial vernier caliper (to the nearest 0.1 mm): snout-vent length (SVL; from the tip of the snout to the anus), tail length (TL; from the anus to the tip of the tail), head length (HL; the distance between the angle of the jaws and the snout-tip),

head width (HW; measured at the angle of the jaws), head depth (HD; the maximum height of the head, from the forehead to the throat), axilla to groin length (A-G; the distance between the posterior edge of the fore limb and the anterior edge of the hind limb), eye diameter (ED; the greatest diameter of the orbit), eye to nostril distance (E-N; the distance between the anterior-most point of the eyes and the nostrils), eye to snout distance (E-S; the distance between the anterior-most point of the eyes and the tip of the snout), eye to ear distance (E-E; the distance from the anterior edge of the ear opening to the posterior corner of the eyes), greatest ear length or ear height (EL; the greatest diameter of the ear opening), and interorbital distance (IO; the least distance between the upper eyelids). The description of *Eublepharis turcmenicus* is derived from Darevsky ("1977", 1978), Nikol'skii (1915) and Grismer (1991). Comparative materials examined have been listed in Appendix I. Institutional abbreviations follow Leviton *et al.* (1985). Colour nomenclature is after Smith (1975; 1981).

Eublepharis fuscus Börner, 1981

Eublepharis macularius fuscus

A.-R. Börner. 1981. *Saurologica, Cologne* (3): 4. (Figures 1 — 3.)

History.- The name *Eublepharis macularius fuscus* was made available for the population from the western Indian peninsula by Börner (1981) in a privately published journal (*Saurologica*). The type locality of the holotype was given as "60 km north of Bombay, India", and a paratype was informally designated of a specimen at the Cologne Zoo, Germany that was earlier examined by Börner (1976). Although considered valid at the subspecific level by subsequent compilations and revisions of eublepharids, including Grismer (1988: 442) and Kluge (1993: 10), no specimens have apparently been examined, and both type specimens, live in the collection of the author and at the Cologne Zoo, Germany, at the time of original description, were not preserved after death (A.-R. Börner, pers. comm., 1995).

Since the original description used somewhat non-conventional character states (e.g., colouration and body proportions) and was published in an obscure journal (and thus is generally unavailable), a redescription of the taxon is provided, along with evidence for a specific, rather than a subspecific status, for the taxon.

Diagnosis.- *Eublepharis fuscus* can be differentiated from *E. macularius* in possessing smooth (as opposed to tuberculate) median scansors on the toes, mentals longer than wide (vs wider than long), a single (not two) broad pale dorsal bands and eight (vs six) postnasals bordering the nasals. It differs from *E. hardwickii* in possessing middorsal tubercles that are smaller (vs larger) than their interspaces, these tubercles also differing in shape, being conical in *E. fuscus* and flattened in the east Indian species; and variegations within the pale bands on the dorsum of the body (absent in *E. hardwickii*). The western Indian species differs from *E. angramainyu* in showing a blotched (as opposed to a linearly-arranged) pattern on the dorsal surface of the head and body, head covered with flat (not convex, polygonal) scales, eight (vs 10) supralabials and mentals longer than broad (vs twice as broad as long), besides being substantially (67 per cent) larger (SVL 252 mm) than the west Asian species (170 mm). Finally, *Eublepharis fuscus* differs from *E. turcmenicus* in showing tubercles on the dorsum that are smaller than the interspace (vs equal to the distance between them), rostral twice as wide as high (vs one and a half times wider than high), a more robust habitus than its west Asian congener; a dorsal body pattern that consists of dark blotches (not partially with a linear pattern) and continuous preanal pores, (preanal pores interrupted medially by one to four scales that lack pores in the congener from Turkmenistan).

Redescription (based on an adult male, BNHM 1047, here being designated neotype Habitus slightly depressed; body robust (Fig. 1); nostrils dorsolaterally oriented; rostrals hexagonal, wider than deep (rostral length/rostral depth ratio 2.00), fails to contact nostrils and bordered posteriorly by nasal and two small scales; six postnasals contacting the nasals; two supralabials contacting nasals; eight supralabials to below pupil; eight infralabials; mental small, hexagonal, longer than wide, about twice as long

FIGURE 1: Dorsal (left) and ventral (right) views of the neotype of *Eublepharis fuscus* (BNHM 1047), from Hingolgadh, Jasdan, Rajkot, Gujarat, India. Markers = 20 mm.

FIGURE 2: Ventral views of toes of eublepharid geckos from western India and Pakistan Neotype of *Eublepharis fuscus* (BNHM 1047), showing smooth subdigital lamellae (on left); *Eublepharis macularius* (BNHM 234/1), showing tuberculate subdigital lamellae (on right).

as the first pair of postmentals, in contact with supralabial I; first pair of postmentals distinctly larger than the gular scales; ear opening higher than wide, as high as the first supralabial; eye to ear distance greater than eye diameter (E-E/ED ratio 1.66); upper eyelids broad; lower eyelids distinct and granular; eight interorbital scale rows at the midpoint of the orbit; tongue nicked at the tip.

Head obtusely pointed in dorsal view, distinct from neck, high (HD/HL ratio 0.85); forehead concave; snout long (HL/SVL ratio 0.15); head broad (HW/SVL ratio 0.2); prefrontal region with smooth, flat scales; distinct fleshy eyelids; enlarged tubercles surrounding the auditory meatus; supralabial I highest; supralabial VIII lowest; external auditory canal deep; large granular and non-spinose tubercles on sides of the head behind tympanic opening and on middle of forehead, to entire dorsum, largest ones being situated laterally; tubercles smaller than intertubercular regions.

Scales on dorsum smooth, hexagonal, juxtaposed; gular and ventral scales smooth, hexagonal and juxtaposed; dorsal tubercles smaller than the intervening distances, pronounced and pointed; gular scales smaller than ventrals on pectoral and abdominal regions; 42 midbody scale rows across belly to below lateral row of tubercles; 11 preanal pores; femoral pores absent. Subdigital scansors (right limb): 10 on finger I, 14 on finger II, 18 on finger III, 18 on finger IV, 12 on finger V; 10 on toe I, 14 on toe II, 17 on toe III, 22 on toe IV, 17 on toe V; limbs meeting when adpressed; fore limbs short; hind limbs moderately long; deep axillary pockets. Digits slender, short, cylindrical, not dilated, all clawed, bearing transverse lamellae ventrally; claws short, recurved, partially concealed under lateral and upper scales; subdigital scansors entire, smooth (Fig. 2); interdigital webbing absent; relative length of fingers: 4 > 3 > 2 > 5 > 1 (fingers) and 2 > 3 > 1 > 4 > 5 (toes).

Tail (original, unregenerated) shorter than head and body (TL/SVL ratio 0.58); flattened dorsally, constricted at base, bearing 14 segments, ending in conical point. Tubercles on dorsal surface of tail arranged in rows, with largest on dorsolateral borders. Subcaudal scales enlarged, wider than long, smooth, hexagonal and juxtaposed. Two postanal sacs at base of tail.

Measurements (in mm).- SVL 82.0-252.0, mean 118.49 ± SE 15.51; TL (tail missing in two examples) 43.6-84.0, mean 68.03 ± SE 5.47; HL 11.7-19.5, mean 16.60 ± SE 0.75; HW 16.9-26.0, mean 20.61 ± SE 0.94; HD 11.4-21.0, mean 14.60 ± SE 0.96; ED 6.6-8.4, mean 7.38 ± SE 0.19; E-E 8.3-13.10, mean 10.58 ± SE 0.51; E-S 8.5-12.1, mean 10.03 ± SE 0.35; E-N 6.0-8.6, mean 7.02 ± SE 0.27; IO 6.1-9.7, mean 8.05 ± SE 0.31; and EL 4.1-4.9, mean 4.40 ± SE 0.15.

Pholidosis.- Preanal pores, six adult males with 8-16, mean 11.0 ± SE 1.1; supralabials, 7-8, mean 7.80 ± SE 0.13.

Colouration (in preservative).- Forehead reticulated with fuscous on a light-drab ground colour. Lips light-drab, not dark barred. One light-drab midbody band between the nuchal loop and caudal constriction, with fuscous spots. Dorsal surface of tail with alternating thick fuscous and narrow light-drab bands. Dorsal surface of limbs with dark blotches and bars. Ventrally, body and tail light-drab. Juvenile colouration is likely to comprise distinct alternating pale and dark bands on the dorsum, as known in *Eublepharis macularius* (see Daniel 1983: Plate 16), since all material examined were adults, bearing light drab midbody bands and several show bands of the same colour across the pectoral and pelvic regions of the dorsum as well. Romulus Whitaker (pers. comm., 1995) mentioned finding a distinctly banded juvenile eublepharid lizard from Sasan Gir, Gujarat state, western India, in May, 1975. The pale-dark contrast on the body in *E. macularius* has been considered aposematic in function (Das, 1992), making these lizards ontogenetically dichromatic. The juvenile colour pattern of bands is also shown in the congeneric *E. hardwickii* by Singh (1984) and Khajuria (1986), *E. angramainyu* by Anderson and Leviton (1966) and *E. turcmenicus* by Rösler and Szczerbak (1993), although in *E. hardwickii*, the banded juvenile pattern is retained by adults (see Grismer, 1988).

COMPARISONS

Four species of *Eublepharis* have been considered valid by Grismer (1988) and Kluge (1993): *E. angramainyu* Anderson & Leviton, 1966, *E. hardwickii* Gray in: Hardwicke and Gray, 1827, *E. macularius* (Blyth, 1854) and *E. turcmenicus* Darevsky, "1977" 1978. *Eublepharis fuscus* falls out as *E. macularius* (distribution: southern and eastern Afghanistan, Pakistan and north-western India) in the key provided by Smith (1935), in possessing enlarged tubercles on the dorsum that are smaller than their interspaces. However, *E. fuscus* can be differentiated from Blyth's species, which has a tuberculate (as opposed to smooth) median scansors on the toes, mentals longer than wide (vs shorter than wide), eight (versus six) postnasals bordering the nasals and one (not two) broad pale dorsal bands between the nuchal loop and the caudal constriction.

The western Indian species differs from its only other Indian congener, *E. hardwickii* (distribution: north-central and eastern India, and probably Bangladesh) in possessing middorsal tubercles that are smaller (versus larger) than their interspaces. The tubercles also differ in shape, being conical in *E. fuscus* and flattened in the east Indian species. Additional points of difference is the absence of axillary groove in *E. hardwickii* (present in *E. fuscus*), presence of variegations within the pale bands on the dorsum of the body in *E. fuscus*, which are absent in the east Indian species, enlarged (vs not enlarged in *E. hardwickii*) subcaudals in *E. fuscus* and two pale bands on the dorsum of the body between the nuchal loop and the caudal constriction (the midbody and pelvic bands) in the east Indian species, while its western congener being described here shows three bands.

In showing smooth scansors, *E. fuscus* is similar to *E. angramainyu* (reported from the western foothills of the Zagros mountains and the upper reaches of the Mesopotamian Plain in Iran and Iraq, between 300-1,000 m: Anderson and Leviton, 1966; Leviton *et al.*, 1992; Nader and Jawdat, 1976; and also the Euphrates-Khabur River region of Syria: Martens and Kock, 1991). The western Indian species differs from the aforementioned species in showing a blotched (as opposed to a linearly-arranged) pattern on the dorsal surface of the head and body, head covered with flat (not convex, polygonal) scales, eight (versus 10) supralabials, rostrals failing to contact the nasals (in contact in *E. angramainyu*) and mentals longer than broad (versus twice as broad as long). The western Indian species is also substantially (67 per cent) larger (SVL to 252 mm) than the west Asian species: the holotype of *E. ensafi* Baloutch and Thireau, 1986 (considered by Grismer, 1989, to be synonymous with *E. angramainyu*), the largest known example of the genus, is 170 mm in SVL.

Eublepharis fuscus differs from the only other congener with smooth scansors, *E. turcmenicus* (described from Turkmenistan, with additional localities given by Bannikov *et al.*, 1977, including Askabad, Bakhardan and the Valley of Arvaz in the Kopet Dag mountains) in showing tubercles on the dorsum that are smaller than the interspace (vs equal to the distance between them), rostral twice as wide as high (vs one and a half times wider than high), a more robust habitus than its west Asian congener (based on a subjective evaluation of photographs in Nikol'skii, 1915: Plate II and Rösler and Szczerbak, 1993: Figs. 2, 3 and 5), and a dorsal body pattern that consists of dark blotches (not partially with a linear pattern). Additionally, the Indian species has continuous preanal pores, while in its congener from Turkmenistan, preanal pores are interrupted medially by one to four scales that lack pores.

DISTRIBUTION

The allopatry between the two western Indian species of eublepharids, *Eublepharis fuscus* and *E. macularius* is suggested in the map in Grismer (1988). The distribution of the former species, based on specific records, is shown in Fig. 3. The Rann of Kachchh in northern Gujarat State, India, appears to be a barrier for both the southern populations of *E. macularius* (in the eastern banks of the Indus, in Sindh Province, southeastern Pakistan) and northern populations of *E. fuscus* (in Kathiawar peninsula, Gujarat State, western India). The Rann is an expanse of tidal flats, with saline efflorescences (Mani, 1974) and its distinctiveness had been noticed as early as the last century by Stoliczka (1872), who thought

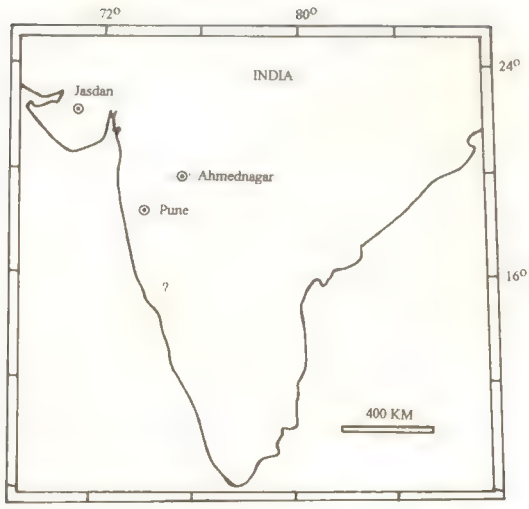

FIGURE 3: Map of central and peninsular India, showing the distribution of *Eublepharis fuscus*. The southern-most record for the taxon, indicated with an interrogation sign, is based on BNHM 225/1 and 225/2, collected from "Kanara" (probably the district of North Kanara, Karnataka State, south-western India).

that Kachchh, with a few of the islands of the Rann, forms a distinct geographical unit. Virtually nothing has been recorded of the natural history of *E. fuscus*. Underwood (1948) collected it from an "area bounded by the hills on either side of the road..", close to Pashan village, Pune, Maharashtra State, in western India.

ACKNOWLEDGEMENTS

Supported by the Centre for Herpetology, Madras Crocodile Bank Trust, the British Council and a Fulbright Fellowship. I thank Gerald Benyr, NMW for drawing my attention to the uniqueness of this species. The Curators of AMNH (Darrell Frost and Linda Ford), BMNH (E. Nicholas Arnold and Colin J. McCarthy), BNHM (Naresh Chaturvedi and Aloysius G. Sekar), MCZ (John Cadle and José Rosado) and ZSI (J. R. Alfred, Shyamal Kumar Chanda and Basudeb Dattagupta) provided permission and facilities to examine their respective holdings. Visit to the BMNH was supported by the British Council Division. Harry V. Andrews, Aaron Bauer, Bill Branch, L. Lee Grismer, Tsutomu Hikida, Robert Frederick Inger, Mohammed Sharif Khan and Romulus Whitaker offered valuable comments on early drafts of the manuscript.

LITERATURE CITED

ANDERSON, S. C. & A. E. LEVITON. 1966. A new species of *Eublepharis* from southwestern Iran (Reptilia: Gekkonidae). *Occ. Pap. Calif. Acad. Sci.* (53): 1-5.

BALOUTCH, M. & M. THIREAU. 1986. Une espece nouvelle de gecko *Eublepharis ensafi* (Sauria, Gekkonidae, Eublepharinae) du Khouzistan (sud ouest de l'Iran). *Bull. Mens. Soc. Linn. Lyon* 55: 281-288.

BANNIKOV, A. G., I. S. DAREVSKY, V. G. ISCHCHENKO, A. K. RUSTAMOV & N. N. SZCZERBAK. 1977. [Guide to the reptiles and amphibians of U.S.S.R.] Enlightenment Publ., Moscow. 414 pp. + 32 pl. [In Russian.]

BLYTH, E. 1854. Proceedings of the Society. Report of the Curator, Zoological Department. *J. Asiatic Soc. Bengal* 23: 737-740.

BÖRNER, A.-R. 1976. Second contribution to the systematics of the southwest Asian lizards of the geckonid (sic) genus *Eublepharis* Gray 1827: Material from the Indian subcontinent. *Saurologica, Cologne* (2): 1-15 + 3 (figs) + 8 (tables) + 9 (figs & Pl. 1-3).

_____. 1981. Third contribution to the systematics of the southwest Asian lizards of the geckonid (sic) genus *Eublepharis* Gray, 1827: Further material from the Indian subcontinent. *Saurologica, Cologne* (3): 1-7 + 13 (tables) + map + Pl. 1-2.

BOULENGER, G. A. 1885. Catalogue of the lizards in the British Museum (Natural History). Volume I. Geckonidae (sic), Eublepharidae, Uroplatidae, Pygopodidae, Agamidae. Second edition. Taylor and Francis, London. xii + 436 pp + Pl. I-XXXII.

DANIEL, J. C. 1983. The book of Indian reptiles. Bombay Natural History Society/Oxford University Press, Bombay. 141 pp.

DAREVSKY, I. S. "1977". 1978. [Range extension or population fluctuations? On the occurrence in southern central Asia of a number of

lizards new to the fauna of the U.S.S.R.] *In:* Fourth All-Union Herpetological Conference. Questions in herpetology. pp: 77-9. I. S. Darevsky (Ed.) Akademiya Nauk SSSR. Zoologischeskij Institut, Nauka. [In Russian.]

DAS, I. 1992. *Cnemaspis madarensis* Sharma (1980), a junior synonym of *Eublepharis* macularius (Blyth, 1854). *Asiatic Herpetol. Res.* 4: 55-56.

GRISMER, L. L. 1988. Phylogeny, taxonomy, classification, and biogeography of eublepharine geckos. *In*: R. Estes & G. Pregill (Eds.) Phylogenetic relationships of the lizard families. Essays commemorating Charles L. Camp. pp: 369-469. Stanford University Press, Stanford.

_____ . 1989. *Eublepharis ensafi* Balouch and Thireau, 1986: a junior synonym of *E. angramainyu* Anderson and Leviton, 1966. *J. Herpetol.* 23(1): 94-95.

_____ . 1991. Cladistic relationships of the lizard *Eublepharis turcmenicus* (Squamata: Eublepharidae). *J. Herpetol.* 25(2): 251-253.

HARDWICKE, R. & J. E. GRAY. 1827. A synopsis of the species of saurian reptiles, collected in India by Major-General Hardwicke. *Zool. J.* 3: 213-229.

KHAJURIA, H. 1986. On habits of some central Indian lizards with morphological notes on *Eublepharis hardwickii* Gray. *Rec. Zool. Surv. India* 83: 19-23.

KLUGE, A. G. 1993. Gekkonoid lizard taxonomy. International Gecko Society, San Diego. 245 pp.

LEVITON, A. E., S. C. ANDERSON, K. ADLER & S. MINTON. 1992. Handbook to Middle East amphibians and reptiles. Society of the Study of Amphibians and Reptiles, Contribution to Herpetology Number 8, Oxford, Ohio. vi + 252 pp; 33 pl.

_____ , R. H. GIBBS, JR., E. HEAL & C. E. DAWSON. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985: 802-832.

MANI, M. S. 1974. Physical features. *In*: M. S. Mani (Ed.) Ecology and biogeography in India. pp: 11-59. Dr. W. Junk Publishers, The Hague,

MARTENS, H. & D. KOCK. 1991. Erstnachweise für drei Gecko-Gattungen in Syrien (Reptilia: Sauria: Gekkonidae). *Senckenbergiana Biol.* 71: 15-21.

NADER, I. A. & S. Z. JAWDAT, 1976. Taxonomic study of the geckos of Iraq (Reptilia: Gekkonidae). *Sci. Res. Found. Biol. Res. Cent. Publ.* (5): 1-41.

NIKOL'SKII, A. M. 1915. Fauna of Russia and adjacent countries. Reptiles. Vol. I. Chelonia and Sauria. Israel Programs for Scientific Translations, Jerusalem. (2) + 352 pp.

RIDE, W. D. L., C. W. SABROSKY, G. BERNARDI & R. V. MELVILLE. (Eds.) 1985. International Code of Zoological Nomenclature. Third Edition adopted by the XX General Assembly of the International Union of Biological Sciences. International Trust for Zoological Nomenclature, London and University of California Press, Berkeley. xx + 338 pp.

RÖSLER, H. & N. N. SZCZERBAK. 1993. Die Jugendentwicklung von *Eublepharis turcmenicus* Darevskij, 1978 im Terrarium. *Salamandra* 28: 275-278.

SINGH, L. A. K. 1984. *Eublepharis hardwickii* (Reptilia, Gekkonidae), the Kalakuta, observed at Tikerpada, Orissa. *J. Bombay nat. Hist. Soc.* 81: 708-708.

SMITH, F. B. 1975. Naturalist's color guide. Parts I and II. The American Museum of Natural History, New York. Part I. 8 pp + 18 colour swatches; Part II. xiii + 229 pp.

_____. 1981. Naturalist's color guide. Part III. The American Museum of Natural History, New York. (iv) + 37 pp.

SMITH, M. A. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II- Sauria. Taylor and Francis, London. xiii + 440 pp + 1 pl.

STOLICZKA, F. 1872. Notes on the reptilian and amphibian fauna of Kachh. *Proc. Asiatic Soc. Bengal* 1872: 71-85.

UNDERWOOD, G. 1948. Notes on Poona reptiles. *J. Bombay nat. Hist. Soc.* 47: 627-632.

APPENDIX 1:

List of referred material.

Eublepharis angramainyu: BMNH 1909.3.20.1: Muhammarah, Iran. MCZ 51636: Chalga village, S. Chemchemal, Kirkuk, Liwa, Iraq.

Eublepharis fuscus: BNHM 222: Khandesh, Maharashtra, western India; BNHM 223: Bhusawal, Maharashtra, western India; BNHM 224: Ahmednagar, Maharashtra, western India; BNHM 225/1 and 225/2: Kanara (= Karnataka, south-western India); BNHM 226: Rajkot, Kathiawar, Gujarat, western India; BNHM 229: Pune, Maharashtra, western India; BNHM 936: Pune, Maharashtra, western India; BNHM 1047: Hingolgadh, Jasdan, Rajkot, Gujarat, western India; BMNH 69.8.28.12. Khandesh, Maharashtra, western India.

Eublepharis hardwickii: AMNH 57593: Deolali, Madhya Pradesh, central India; BMNH 1946.8.26.67 (holotype of *Eublepharis hardwickii*) "Penang, Chittagong" (in error); BMNH 1962.238: Russelconda, south-central India; BMNH 1962.239: Russelconda, south-central India; BMNH 1927.8.9.1: Dhalbhum, Chota Nagpur, Bihar, eastern India; BMNH 61.12.30.87: "Anamalley Mount" (= Anaimalai Hills, Tamil Nadu State, south-western India; in error).

Eublepharis macularius: AMNH 57594. Cherat, Balochistan northern Pakistan; AMNH 47425. 16 miles north of Bela, Las Belas District, southern Pakistan; AMNH 102486. 32 miles south of Wadi, Kalat District, central Pakistan; AMNH 27708. Rajanpur, Punjab, eastern Pakistan; AMNH 88594. 16 miles northeast of Quetta, Quetta District, northern Pakistan; AMNH 88581. Kach, Sibi District, central Pakistan; AMNH 82192. 2.5 miles east of Hab Chowki, Karachi, Federal District, southern Pakistan; BNHM 232: Zhob, Balochistan, northern Pakistan; BNHM 234/1 and 234/2: Fort Sandeman, Balochistan, northern Pakistan; BNHM 236: Charat, Balochistan, northern Pakistan; BNHM 237: Katwai, Shakpur, Salt Range, Punjab, eastern Pakistan; BNHM 238: Rhotak, Pakistan; BNHM 239: Sukkur, western Pakistan; BNHM 240: Larkana, Sindh, southern Pakistan; BNHM 241: Karachi, Sindh, southern Pakistan; BMNH 73.7.3.13. "Between Cashmere and Murree" (in north-western Pakistan); BMNH 1946.8.26.65-66 (holotype of *Eublepharis fasciolatus*): Hyderabad, Sindh, southern Pakistan; ZSI 6224 (holotype of *Cyrtodactylus macularius* Blyth, 1854), "Punjab Salt Range" (in southern Pakistan); ZSI 20161: Station 28, Garial, Punjab, northern India; ZSI 23192: Jhajjarkothy District, Jammu, Jammu and Kashmir State, northern India.

Accepted: 14 June, 1997.

Hamadryad, Vol. 22, No. 1, pp. 21 – 27, 1997.

PHILAUTUS SANCTISILVATICUS (ANURA: RHACOPHORIDAE), A NEW FROG FROM THE SACRED GROVES OF AMARKANTAK, CENTRAL INDIA

Indraneil Das* and Shyamal K. Chanda**

*Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India
** Zoological Survey of India, Fire-Proof Spirit Building, 27 J. L. Nehru Road, Calcutta 700 016, India
(with two text figures)

ABSTRACT.- A new species of *Philautus* is described from the Amarkantak, Madhya Pradesh, central India and compared with congeners from peninsular India and Sri Lanka. *Philautus sanctisilvaticus* sp. nov. is diagnosable from Indian and Sri Lankan species in possessing the following characteristics: head wider than long; tympanum small, concealed; webbing on toe IV up to basal subarticular tubercle on the inner side and to the distal subarticular tubercle on the outer side; dorsum brownish-grey, with a dark forehead, the sides of the body with brown and cream reticulations; SVL of holotype, a mature male, 20.8 mm; two paratopotypes, both adult females, 19.3 and 23.8 mm.

KEY WORDS.- Taxonomy, amphibians, *Philautus*, new species, sacred groves, Madhya Pradesh, central India.

INTRODUCTION

Hora (1949) used the instances of distributional disjunctions in Indian plants and animals to put forward the Satpura Hypothesis, which provide a working explanation to explain the co-occurrence of moist forest species in south-eastern Asia and the Western Ghats (although not on the intervening mostly xeric plains of northern and central India). Under this scenario, the once forested Siwaliks on the outer ranges of the Himalayas, acted as a causeway that allowed the emigration of Indo-Malayan biota into peninsular India. The Satpura Hypothesis has been generally criticized as being without geological support (but see Swan, 1993 for a recent argument in support), the distributional disjunctions shown by the biota thought to be relictual of an ancient, more wider distributional (see for instance, Das, 1996; Dilger, 1952; Erdelen, 1989; Jayaram, 1974; Kottelat, 1989).

An example of faunal disjunction is shown by the anuran genus *Philautus* Gistel, 1848 whose mesic condition tolerating members range from Sri Lanka and south-western peninsular India, and then, after a gap of over a thousand kilometres, reappear in north-eastern India, from where they range south (to the Malay Peninsula and Archipelago) and east (to southern China and the Philippines; see Frost, 1985; Inger and Dutta, 1986. In a separate paper (Das and Chanda, in press), we describe a new species of this genus from the southern Eastern Ghats, which is assumed to represent another species showing relictual distribution. Dutta (1991) reported the genus from Orissa, based on a material (not allocated to species) in the collection of the United States National Museum, Washington, D.C., USA.

The present paper reports yet another new species of *Philautus* from the so-called dry zone of central India, from the headwaters of the rivers Narmada and Sone, in Jabalpur District, Madhya Pradesh State, and formally describe it on the basis of three adults. The discovery of the new species helps bridge the discontinuous distribution of the genus, and suggests the occurrence of members of the species, at least some of which we suspect are undescribed, from other relatively moist regions. The genus *Philautus* was hitherto known to contain 23 species, the Sri Lankan fauna seven species, with three species that reportedly co-occur in Sri Lanka and mainland India (Dutta, 1985; Dutta and Manamendra-Arachchi, 1996; Das and Chanda, in press). We

allocate the species to the genus *Philautus* for presence of the following features described as diagnostic by Liem (1970): small body size (SVL 25 mm), lack of vomerine teeth, fingers free, toes up to half webbed, circummarginal groove present, digital disc present and trapezoid frontoparietal of the cranium. The last revision of the group was by Ahl (1931), although Dring (1987) treated the Bornean *Philautus* species, considering loss of vomerine teeth, reduction or loss of nuptial pads and pigmented ova to be derived characters within the genus.

MATERIALS AND METHODS

Measurements were taken with a Mitutoyo™ dial vernier calliper (to the nearest 0.1 mm) from specimens that have been preserved in ethanol. Data on measurements of the paratypes should be used with caution, since these were measured over 120 years after collection. The following measurements were taken: snout-vent length, SVL (from tip of snout to vent); tibia length, TBL (distance between surface of knee to surface of heel, with both tibia and tarsus flexed); trunk length, TL (distance between posterior edge of forelimb at its insertion to body to anterior edge of hind limb at its insertion to body); head length, HL (distance between angle of jaws and snout-tip); head width, HW (measured at angle of jaws); head depth, HD (greatest transverse depth of head, taken beyond orbital region); eye diameter, ED (diameter of orbit); eye to tympanum distance, E-T (distance between posterior-most point of eyes and anterior-most point of tympanum); upper eyelid width, UE (greatest width of upper eyelid); interorbital width, IO (least distance between upper eyelids); internarial distance, IN (distance between nostrils); eye to snout-tip distance, E-S (distance between anterior-most point of eyes to tip of snout); eye to nostril distance, E-N (distance between anterior-most point of eyes and nostrils); greatest horizontal diameter of tympanum, HTYD (measured along horizontal plane); greatest vertical diameter of typanum, VTYD (measured along vertical plane); and diameter of disk on finger III, FIIID (width of disk at tip of finger III). The types were sexed through gonadal examination.

Institutional abbreviations follow Leviton *et al.* (1985). Sources of information of distribution of conspecifics with which the new species has been compared are Duellman (1993), and Frost (1985). Comparative material examined are in Appendix I; other nominal species, especially Rao's (1937) new species, which are, with one exception (*Philautus charius*), known only from the types that are now lost (see Frost, 1985) are from the original description.

Philautus sanctisilvaticus sp. nov.
(Figures 1 — 2)

Holotype: ZSI A1778 (adult male), from Kapildhara Falls, Amarkantak (23° 10'N; 81° 70'E), ca. 190 km SE Jabalpur City, Shahdol, Jabalpur District, Madhya Pradesh, central India. Collected by P. Singh, 23 May, 1962.

Paratopotypes: ZSI A1777 and A1779 (both adult females), collector as above, dates of collection 8 May, 1962 and 26 May, 1962, respectively.

Diagnosis: Philautus sanctisilvaticus sp. nov. is diagnosable from known congeners in possessing the following characteristics: head wider than long; tympanum small, concealed; webbing on toe IV up to basal subarticular tubercle on the inner side and to the distal subarticular tubercle on the outer side; dorsum brownish-grey, with a dark forehead, the sides of the body with brown and cream reticulations; SVL of holotype, a mature male, 20.8 mm; two paratopotypes, both adult females, 19.3 and 23.8 mm.

Description (based on holotype): A small species of *Philautus* (SVL 19.3-23.8 mm); habitus relatively robust with a narrow waist; head short (HL/SVL ratio 0.31), wider than long (HL/HW ratio 0.90), snout flattened (HL/HD ratio 1.59); obtusely pointed, projecting beyond mandible, nostrils closer to orbit than to tip of snout (E-N/E-S ratio 0.56), canthus rostralis vertical in transverse section; lores weakly concave. Eye large (ED/HL ratio 0.49), its diameter greater than eye-nostril distance (ED/E-N ratio 2.13), interorbital distance slightly less than twice width of upper eyelid (IO/UE ratio 2.28); internarial region narrow (IN/ED ratio 0.91); supratympanic fold commences from posterior corner of orbit, crossing

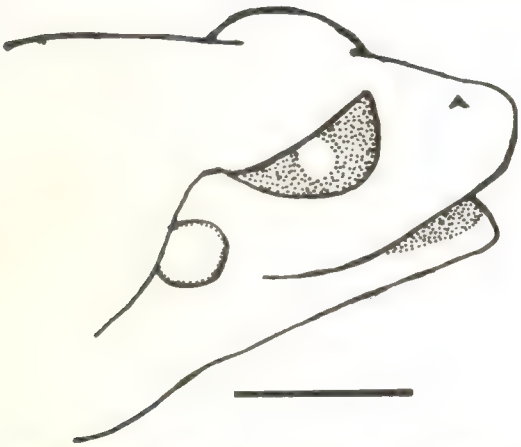

FIGURE 1: Head of holotype of *Philautus sanctisilvaticus* (ZSI A1778). Marker = 3 mm.

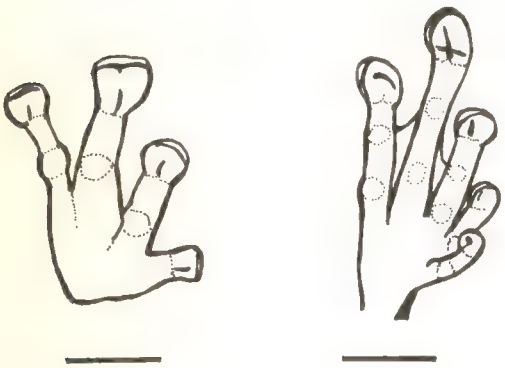

FIGURE 2: Fore and hind limb of the holotype of *Philautus sanctisilvaticus* (ZSI A1778), showing the subarticular tubercles and webbing on the palm (left) and sole (right), respectively. Markers = 2 mm.

over tympanum, and dipping down, to cross over insertion of forelimb; tympanum small, concealed, flattened, less than that of orbit in diameter (HTYD/ED ratio 0.02), situated postero-ventrally to orbit; its greatest diameter at a vertical plane (HTYD/VTYD ratio 0.06; Fig. 1). Nostrils laterally oriented and oval in shape, their greatest diameters vertically oriented. Vomerine teeth absent; choanae oval, separated from each other by a distance over 10 times width; inferior aspect of snout weakly nicked; inner margin of mandible tip with a slight w-shaped notch. Tongue large (5.0 mm in length), slightly elongate (4.3 mm in width), its dorsal surface with scattered papillae; bifid and free posteriorly for approximately 60 per cent length.

Tips of fingers dilated into large, rounded and flattened disks, with distinct circummarginal grooves separating dorsum of disks from ventrum; a smooth, pale nuptial pad on base of dorsal surface of finger I. The largest digital disk is on finger III, which is less than vertical diameter of tympanum (FIIID/VTYD ratio 1.18). Fingers unwebbed (Fig. 2); dorsal surface of base of finger I with a pale, smooth nuptial pad; relative lengths of adpressed fingers: 3 > 2 > 4 > 1.

Tibia long (TBL/SVL ratio 0.49); tips of toes strongly dilated into flattened disks, with circummarginal grooves that separate dorsum of disks from ventrum, and are as large as those on fingers. Reduced webbing on toes: toe I with rudimentary webbing, outer side without a dermal fringe; webbing on toe II up to distal subarticular tubercle on outer and inner edges, reaching the base of disks on inner as a narrow sheath; on toe III, webbing is up to basal subarticular tubercle on outer edge, reaching base of disks on both sides; on toe IV, to basal subarticular tubercle on inner and distal on outer, reaching base of disks as a narrow sheath; and on toe V, to distal subarticular tubercle as a broad web, reaching disk base as a narrow sheath on inner edge (Fig. 2); outer edge of toe V with a dermal fringe; tarsal fold absent; a small elongated inner metatarsal tubercle; outer metatarsal tubercle absent; relative lengths of adpressed toes: 4 > 3 > 5 > 2 > 1.

Dorsum of body smooth, except for a narrow median dermal fold along dorsum; upper eyelids tuberculate; throat, pectoral; abdominal region as well as undersurface of thighs with large, flattened, juxtaposed tubercles; undersurface of forelimbs smooth. Cloacal opening directed postero-ventrally, slightly below upper level of thighs.

Colouration (in preservative): Body unpatterned brownish-grey dorsally, forehead darker than rest of body; fore and hind limbs banded with dark brown; tips of digits of fore and hind limbs pale yellow; throat brownish, pectoral and abdominal regions with brown variegations. Lateral aspect of torso between axilla and groin with brown and cream reticulations; an-

TABLE 1: Measurements of the type series of *Philautus sanctipalustris*.

	ZSI A1777	ZSI A1778	ZSI A1779
sex	female	male	female
SVL	19.3	20.8	23.8
TL	8.7	7.3	10.9
HL	6.4	6.5	7.3
HW	7.2	7.2	9.3
HD	4.2	4.1	4.7
ED	3.2	3.2	3.5
UE	1.7	1.8	1.8
IO	4.1	4.1	4.3
IN	2.7	2.9	2.8
E-S	2.6	2.7	2.7
E-N	1.9	1.5	1.4
TBL	10.0	10.1	10.9
FIIID	1.0	1.3	1.1

terior edge of hind limbs reticulated with brown and cream.

Variation: ZSI A1777 shows a series of short dermal folds on the dorsum, which is an unpatterned grey-brown. Measurements of the type series are in Table 1.

Etymology: Latin for sacred forest dweller. Noun in apposition.

Natural history: No ecological data are available on the type series, and the larval stages of the new species are unknown.

The type locality lies in the Maikala (Mikul or Mekala) Range, and is the source of both the rivers Narmada and Sone (Mani, 1974). Amarkantak, a major pilgrimage site in central India, particularly for performing the Sradh (Hindu funeral) ceremony (Dey, 1927). The discovery of a new frog species from a locally protected mesic forest within a largely arid region illustrates the importance of fragmented forests. Patches of locally protected forests in India are known to be the sole refuge of several other species of both plants and animals, such as the woody climber, *Kunstleria keralensis* (Mohanan and Nair, 1981), from Kerala State, and the ranid frog, *Nyctibatrachus sanctipalustris* (in Latin, 'dweller of sacred swamps'), described by Rao (1920) from the "sacred swamps of the Cauvery, Brahmagiri hills" in northern Karnataka State. Limited tree felling and even local protection given to forests as sacred groves around pilgrimage sites may thus contribute to indigenous efforts to protect biological diversity (see Gadgil, 1985; 1989).

COMPARISONS

The new species is compared with congeners from peninsular India and Sri Lanka. Only characters that separate congeners from the new species have been listed.

Philautus beddomii (Günther, 1875) (distribution: south-western India), snout length equals orbit; and dorsum green; *P. bombayensis* (Annandale, 1919) (distribution: south-western India), tongue with a median papilla; outer toes with dermal fringes; *P. charius* Rao, 1937 (distribution: south-western India), snout length equals orbit; tympanum in contact with orbit; and webbing on toe IV between distal and basal subarticular tubercles; *P. chalazodes* (Günther, 1875) (distribution: south-western India), presence of a median conical papilla on tongue; and dorsum greenish; *P. crnri* Dutta, 1985 (replacement name for *Philautus longicrus* Rao, 1937: distribution: south-western India), presence of an outer metatarsal tubercle; *P. elegans* Rao, 1937 (distribution: south-western India), a median conical lingual papilla present; eye-nostril distance exceeds eye-snout distance; and dorsum crimson; *P. eximius* Shreve, 1940 (distribution: Sri Lanka), fingers weakly webbed; webbing on toe IV on inner edge, to distal subarticular tubercle, and on outer edge, between disk and distal subarticular tubercle; inner metatarsal tubercle present; area surrounding vent tuberculate; and a conical lingual papilla; *P. femoralis* (Günther, 1864) (distribution: south-western India and Sri Lanka), webbing on toe IV, on inner edge, broadly to basal subarticular tubercle, reaching disk base as a narrow sheath; head with a dark lateral head stripe; *P. flaviventris* (Boulenger, 1882) (distribution: south-western India), tongue with a median conical papilla); snout as long as orbit; tympanum exposed; and posterior edge of thighs with rounded yellow spots.

Philautus glandulosus (Jerdon, 1853) (distribution: south-western India), tympanum in contact with orbit; toe IV webbing, on outer edge, between basal and distal tubercle; on inner edge, below basal tubercle; presence (illustrated in Ahl, 1931: 131) of a dark line between posterior corner of orbit and inguinal region; *P. hassanensis* Dutta, 1985 (replacement name for *Philautus montanus* Rao, 1937: distribution: south-western India), lingual papilla present; snout not projecting beyond mandible; larger size: SVL of holotype (sex not mentioned) of *P. montanus* was 37.0 mm); and a v-shaped occipital fold; *P. hypomelas* Günther, 1876, an acutely oriented snout; snout length equals orbit; and webbing on toe IV either broadly up to basal tubercle, continuing as a narrow sheath to proximal tubercle or as a narrow sheath to distal tubercle; *P. kottigeharensis* Rao, 1937 (distribution: south-western India), acutely-oriented snout; eye-nostril distance equals eye-snout distance; and presence of a median conical lingual papilla.

Philautus leucorhinus (Lichtenstein & Martens, 1856) (distribution: south-western India and Sri Lanka), acutely oriented snout; and webbing on toe IV, on outer edge, broadly to basal, reaching distal subarticular tubercle as a narrow sheath; on inner edge; *P. melanensis* Rao, 1937 (distribution: south-western India), median conical lingual papilla present; and orbit diameter equals width of upper eyelid; *P. narainensis* Rao, 1937 (distribution: south-western India), lingual papilla present; and absence of a supratympanic fold; *P. nasutus* (Günther, 1868) (distribution: Sri Lanka), presence of a dermal flap on tibio-tarsal articular region and a dermal appendage on the rostral region; and presence of an inner metatarsal tubercle.

Philautus noblei (Ahl, 1927) (distribution: south-western India), fingers with rudimentary webbing; lores vertical and supratympanic fold indistinct; *P. parkeri* (Ahl, 1927) (distribution: south-western India), larger body size: SVL 35 mm; loreal stripe brownish; and presence of a median conical lingual papilla; *P. pulcherimus* (Ahl, 1927; replacement name for *Ixalus pulcher* Boulenger, 1882: distribution: south-western India), webbed fingers; dorsum green; toes "half to two-thirds webbed"; and dorsum with a dark saddle-like mark; *P. signatus* (Boulenger, 1882) (distribution: south-western India), tongue with a median conical papilla; snout as long as orbit; an acutely oriented snout; upper labials with white spots; and dorsum with an X-shaped mark; *P. swamianus* Rao, 1937 (distribution: south-western India), median conical lingual papilla present; and supratympanic fold inconspicuous. *P. temporalis* (Günther, 1864) (distribution: south-western India and Sri Lanka), tympanum in contact with orbit; snout acutely oriented; dorsum tuberculate; fingers weakly webbed; and webbing on inner side of toe IV fails to reach basal tubercle; *P. travancoricus* (Boulenger, 1891) (distribution: south-western India), snout as long as orbit; dorsum pale, the type being described as being of a "cream-colour" and larger size (SVL 31 mm); and *P. variabilis* (Günther, 1868) (distribution: south-western India and Sri Lanka), tympanum in contact with orbit; snout acutely oriented; and webbing on toe IV between basal and distal tubercles on outer edge.

ACKNOWLEDGEMENTS

For curatorial support, we thank E. Nicholas Arnold and Colin J. McCarthy (BMNH), Alan Resetar and Harold Voris (Field Museum of Natural History; FMNH); John Cadle and José Rosado (Museum of Comparative Zoology; MCZ), Kelum Manamendra-Arachchi and Rohan Pethiyagoda (Wildlife Heritage Trust of Sri Lanka; WHT), J. R. Alfred (Zoological Survey of India; ZSI) and M. S. Ravichandran (Zoological Survey of India, Southern Regional Collection, ZSI/SRS. For comments and/or discussion, we thank Debal Deb, Sushil K. Dutta, Darrell Frost and Kelum Manamendra-Arachchi.

LITERATURE CITED

AHL, E. 1931. Amphibia Anura III. Polypedatidae. Das Tierreich 55. Walter de Gruyter & Co., Berlin & Leipzig. xvi + 477 pp.

DAS, I. 1996. Biogeography of the reptiles of south Asia. Krieger Publishing Company, Malabar, Florida. 16 colour plates + vii + 87 pp.

_____ & S. K. CHANDA. In press. A new species of *Philautus* (Anura: Rhacophori-

dae) from the Eastern Ghats, south-eastern India. *J. south Asian nat. Hist.*

DEY, N. L. 1927. The geographical dictionary of ancient and mediaeval India. Second edition. Luzac & Co., London. (1 folding map) + ix + (1) + 262 pp. Reprinted 1990, 1994, Low Price Publications, Delhi.

DILGER, W.C. 1952. The Brij Hypothesis as an explanation for the tropical faunal similarities between the Western Ghats and the eastern Himalayas, Assam, Burma, and Malaya. *Evolution* 67: 125-127.

DRING, J. 1985. Bornean treefrogs of the genus *Philautus* (Rhacophoridae). *Amphibia-Reptilia* 8: 19-47.

DUELLMAN, W. E. 1993. Amphibian species of the world: Additions and corrections. *Univ. Kansas Mus. nat. Hist. Sp. Publ.* (21): i-iii + 1-372.

DUTTA, S. K. 1985. Amphibians of India and Sri Lanka. Unpublished doctoral dissertation, University of Kansas, Lawrence, Kansas. 353 pg.

_____ . 1991. An overview of the amphibian fauna of Orissa. *Herpeton* 4: 7-8.

_____ & K. MANAMENDRA-ARACHCHI. 1996. The amphibians of Sri Lanka. Wildlife Heritage Trust of Sri Lanka, Colombo. 230 pp.

ERDELEN, W. 1989. Aspects of the biogeography of Sri Lanka. *In*: Forschungen auf Ceylon. III. pp: 73-100. U. Schweinfurth (Ed.) Franz Steiner Verlag, Stuttgart.

FROST, D. R. (Ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc. and Association of Systematics Collections, Lawrence. v + 732 pp.

GADGIL, M. 1985. Social restraints on resource utilization: the Indian experience. *In*: Culture and conservation: the human dimension in environmental planning. pp: 135-154. J. A. McNeely & D. Pitt (Eds.) Croom Helm, London, Sydney, Dover and New Hampshire.

_____ . 1989. The Indian heritage of a conservation ethic. *In*: Conservation of the Indian heritage. pp: 13-22. B. Allchin, E. R. Allchin & B. K. Thapar (Eds.) Cosmo Publications, New Delhi.

HORA, S. L. 1949. Satpura Hypothesis of the distribution of the Malayan fauna and flora to Peninsular India. *Proc. Nat. Inst. Sci. India* 15: 207-422.

INGER, R. F. & S. K. DUTTA. 1986. An overview of the amphibian fauna of India. *J. Bombay nat. Hist. Soc.* 83(suppl.): 135-146.

JAYARAM, K. C. 1974. Ecology and distribution of fresh-water fishes, Amphibia and reptiles. *In*: Ecology and biogeography in India. pp: 517-584. M. S. Mani (Ed.) Dr. W. Junk b.v. Publishers, The Hague.

KOTTELAT, M. 1989. Zoogeography of the fishes from Indochinese inland waters with an annotated checklist. *Bull. Zoöl. Mus. Amsterdam* 12: 1-56.

LEVITON, A. E., R. H. GIBBS, Jr., E. HEAL, & C. E. DAWSON. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985: 802-832.

LIEM, S. S. 1970. The morphology, systematics, and evolution of the Old World treefrogs (Rhacophoridae and Hyperoliidae). *Fieldiana Zool.* 57: i-vii; 1-145.

MANI, M. S. 1974. Physical features. *In*: Ecology and biogeography in India. pp: 11-59. M. S. Mani (Ed.) Dr. W. Junk b.v. Publishers, The Hague.

MOHANAN, C. N. & N. C. NAIR. 1981. *Kunstleria* Prain- a new genus record for India and a new species in the genus. *Proc. Indian Acad. Sci. B* 90: 207-210.

RAO, C. R. N. 1920. Some south Indian batrachians. *J. Bombay nat. Hist. Soc.* 27: 119-127, Pl. I - II.

_____. 1922. Notes on batrachian. *J. Bombay nat. Hist. Soc.* 28: 439-447.

SWAN, L. W. 1993. The Satpura Hypothesis: A biogeographic challenge to geology. *J. Bombay nat. Hist. Soc.* 90: 141-157.

APPENDIX I

Philautus bombayensis: ZSI 18814, 18818, Khandala, Pune District, Maharashtra, south-western India; ZSI 18288, Castle Rock, North Kanara District, Karnataka State, south-western India.

Philautus chalazodes: ZSI 17027, Anaimalai Hills, Tamil Nadu State, south-western India.

Philautus charius: FMNH 218101-02, Ponmudi, Trivandrum District, Kerala State, south-western India.

Philautus eximius: MCZ 20879-84 (syntypes of *Philautus eximius* Shreve, 1940), "Queenwood Estate, Dimbulla, 5000 feet, Ceylon" (= Sri Lanka).

Philautus femoralis: FMNH 218114-117, Ponmudi, Trivandrum District, Kerala State, south-western India; MCZ 15407, Sri Lanka; ZSI 1377, "Ceylon" (= Sri Lanka).

Philautus hypomelas: BMNH 1947.1.7-10; 1947.2.7.47-52 (syntypes of *Ixalus hypomelas* Günther, 1876), "Ceylon" (= Sri Lanka).

Philautus glandulosus: FMNH 74159-60, "South India"; MCZ 79851, Ootacamund to Nilambur, Tamil Nadu State, south-western India; MCZ 15408, Kudra Mukh, south-western India.

Philautus leucorhinus: FMNH 173352, 173358, Ratnapura, Sri Lanka; MCZ 8198-99, India and Ceylon; MCZ 1322, "India"; MCZ 3487, Nuwara Eliya, Central Province, Sri Lanka; ZSI 10680, "South India".

Philautus nasutus: MCZ 3787, Punduloya, Sri Lanka; ZSI 10797, "Ceylon" (= Sri Lanka); WHT 01148, Watagala, near Deniyaya, Sri Lanka.

Philautus pulcherrimus: ZSI/SRS VA 674, Varagaliar Shola, Top Slip, Anaimalai Wildlife Sanctuary, Tamil Nadu, south-western India; ZSI 13565, "South India".

Philautus signatus: ZSI/SRS VA 452, Silent Valley, Kerala State, south-western India; ZSI 2827, "Travancore", Kerala State, south-western India.

Philautus strictomerus: ZSI 10946, "Ceylon" (= Sri Lanka).

Philautus temporalis: FMNH 174296-97, Kotegehar, Karnataka State, south-western India.

Philautus variabilis: FMNH 218133-34, Ponmudi, Trivandrum District, Kerala State, south-western India; FMNH 212990, Chandanthode Reserve, Trichur District, Kerala State, south-western India; MCZ 1276, India; MCZ 12895, 15019, Bogawan Talawa, Central Province, Sri Lanka; WHT 01156, Kanneliya, Galle, Sri Lanka; ZSI/SRS VA 672, Kamaraj Sagar, Ooty, Tamil Nadu, south-western India.

Accepted: 10 June, 1997.

SEX DETERMINATION OF MONITOR LIZARDS IN THE FIELD - A REVIEW OF METHODS

Maren Gaulke

Helene-Mayer-Ring 14 (18. St.), 80809 München, Germany

ABSTRACT.- In contrast to many other lizard groups, sexing of monitor lizards in the field is difficult, and without capture and close examination, is often virtually impossible. In many species of the *Odatria* subgroup, males can be recognized by scalation adjacent to the vent; while scalation differences in many other species are inconspicious or absent. Even sex determination based on the tracing of the male copulatory organs can be misleading, as female monitors possess a similar structure (the hemiclitoris).

KEY WORDS: *Varanus*, sex determination, field techniques, sexual dimorphism.

INTRODUCTION

The aim of field investigations is to increase our understanding of biology and ecology of an animal group, which may include a variety of aspects, including habitat preferences, reproductive behaviour, feeding strategies, thermoregulation, inter- and intraspecific behaviour, etc. For interpretation of many behavioural sequences, knowledge of sex of the animal is fundamental. Many lizard groups, primarily agamids and iguanids, show conspicious secondary sexual characters including differences in dermal appendage and colour pattern differences which enable reliable determination of sex. Specific problems during field investigations are attributable to all animal groups, be it their secretive lifestyle, or low population density. In this author's experiences, a major problem affecting field investigations of monitor lizards is the difficulty in determining their sex. The external intersexual differences reported for monitor lizards are listed, and their suitability for sex determination in the field discussed.

EXTERNAL INTERSEXUAL DIFFERENCES

1: *Differences in size, shape, and colouration*: In most monitor lizards that have been studied, males grow faster and reach a bigger maximum size (longer and heavier) than females (Mertens, 1942a; Shine *et al.*, 1996). For example, in *Varanus bengalensis*, the largest adult males have a snout-vent-length about 30 per cent greater than the largest females (Auffenberg, 1994), and in *V. salvator*, the difference is about 17 per cent (Khan, 1969).

Males of some Australo-Asian and African monitor lizards, including *Varanus salvadorii* and *V. albigularis*, develop bulbous snouts with extreme old age (Bennett, 1995).

The relative hind limb length seems to be somewhat larger in the males of some species: male *Varanus bengalensis* show a different gait compared to females (F. Ahsan, pers. comm.).

Males of *Varanus griseus* and *V. flavescens* tend to become a more brightly coloured during the breeding season (Mertens, 1942b).

2: *Scalation differences*: In some of the species belonging to the mainly Australian subgenus *Odatria*, including *Varanus acanthurus*, *V. gilleni*, *V. glebopalma* and *V. scalaris*, the males have conspicious spiny scales at the sides of the vent, which are less pronounced or even absent in the females (Mertens, 1942a).

The males of *Varanus komodoensis* have small-scale rosettes cranial to the vent (Auffenberg, 1981); scalation differences in the cloacal region, consisting of more prominent skin flaps and pores in the males, are also reported for *V. flavescens* (Whitaker and Khan, 1982) and *V. bengalensis* (Whitaker and Khan, 1982; Yadav and Rana, 1988).

Male *Varanus bengalensis* have more extended skin with scale micropores, tiny pits on the scales, below and above the lateral skin fold, which can be seen macroscopically, espe-

cially in juveniles, according to Auffenberg (1994).

3: *Hemipenes*: The tail base of male monitor lizards is usually broader and bulkier than in females, due to the retracted hemipenes (Bennett, 1995; Whitaker and Khan, 1982).

Male monitor lizards sometimes evert their hemipenes when caught or suddenly lifted (Honegger, 1978; Horn, 1980).

The inverted hemipenes can be traced by a probe (Honegger, 1978). The hemipeneal pockets are carefully penetrated with a medical probe, and the penetration length measured. Penetration of a relatively long distance (subcaudal IX-XV in snakes, according to Laszlo, 1975, but there is in general, no sharp definition in the case of varanids) is considered indicative of males.

4: *Sex specific behaviour*: Many monitor lizard species are known to perform ritual combat, which usually are interpreted as rival combats in competition for females (Carpenter and Ferguson, 1977; Deraniyagala, 1957; Worrell, 1963).

Observations of egg laying in the field are very rare. In some species, like *Varanus niloticus* and *V. bengalensis*, females are reported to return to nest sites (e.g., Biswas and Kar, 1981).

DISCUSSION

Differences listed under size, shape, and colouration are of little use during field investigations. A monitor lizard of exceptional large size and weight is with high probability a male. However, the vast majority of animals seen usually belong to size classes which include both sexes. Recognition of differences in the shape of the snout, or in the gait due to longer hind limbs certainly need a lot of practice. They usually will be discernible only while making direct comparisons between a number of animals. Seasonal differences in colouration are of little use for the field worker. It is unlikely that the same animal can be observed for a period long enough to discern a physiological colour change.

The differences listed under scalation and hemipenes require close examination of the animal, and therefore its temporary capture.

The members of the Odatria subgroup obviously cause the slightest sexing problems. However, one cannot completely rely on the absence or presence of spiny scales at the cloacal region. In some members of this subgroup, their size difference is small and in *Varanus storri*, the spiny scales occur in females too. The existence of more prominent skin flaps and pores around the cloacal region of the males of some monitor lizards is discernible only to the more experienced field worker, and certainly not all specimens can be sexed in this manner. There always will remain a number of animals with an intermediate state.

For several of the larger monitor lizard species, as for example *Varanus salvator* or *V. niloticus*, no scalation differences are described. The tracing of the hemipenes remains the most widely used method for sexing. Unfortunately, new investigations show that these methods, as listed above, are much less reliable than formerly assumed.

It is long known that female squamates too possess structures that can cause a slight swelling at the tail base (Agrawal, 1954), which can be misinterpreted as the bulge of the hemipenes. Green and King (1993) stated that female *Varanus rosenbergi* have organs that resemble the hemipenes, and therefore make sex determination of this species difficult. Recent studies of Ziegler (1996) and Ziegler and Böhme (1996; in press) show that these structures are typical for varanoid squamates in general. These hemiclitores (after Ziegler and Böhme, 1996) are shorter and smaller than the hemipenes and show similar ornamentation, including a sulcus spermaticus. They can even be everted. With this knowledge, one cannot be completely sure that an everted organ really indicates a male. When using the probing method, one has to be extremely accurate, and the following points have to be observed: 1. Probing has to be done very carefully. Otherwise the elastic tissue might be stretched and the length overestimated, or the organ might even be pierced. 2. Monitor lizards are able to hinder complete penetration of the probe by muscle contractions. It is advisable that probing of an animal be done several times, after capture and again before release. If there are significant differences one should use the longest determined length, not the average, if measured without

force. The shorter measurements are probably due to muscle contractions. 3. It is absolutely necessary to probe both pockets; one of the organs might be deformed.

From my own experiences, I know that there are quite a few animals belonging to an intermediate state between a long and a short pocket length. Therefore, the probing method is only usable below and above a critical point, which certainly is species specific. In *Varanus salvator marmoratus*, I determined with relatively high reliability animals with a pocket length up to 2.5 cm to be females, and animals with a pocket length above 3.5 cm to be males (some animals were later dissected, and the results confirmed). About 25% of all measured animals had a length between 2.5 and 3.5 cm, and therefore were regarded as undeterminable in the field (Gaulke, 1989).

A somewhat refined probing method is the fiberoptic laparoscopy introduced for sexing varanids by Davis and Phillips (1991). This method allows not only the measurement of pocket length, but also the optical investigation of the structure. However, there still exists the liability of confusing hemipenes and hemiclitores.

One also has to be careful with a sex determination based on behavioural observations. It is widely assumed that monitor lizards observed during ritual combat are males, competing for females. We do have proof that at least in *Varanus salvator* and in *V. varius*, females too engage in bipedal combat (Horn *et al.*, 1994). In the former, these combat occur in connection with competition in feeding aggregations, and is not connected with reproductive behaviour (Gaulke, 1989).

It is undeniable that a monitor lizard laying eggs is a female. However, later visits to the nest site might be visits from foraging adults, not from the female producing these eggs, nor a member of the sex at all. It is known that at least some species of varanids feed on eggs, including those of conspecifics (Auffenberg, 1994).

CONCLUSION

Unfortunately, no universal method for the reliable determination of sex in monitor lizards in the field is available. Nevertheless, most experienced field workers will be able to tell the sex of their subjects after examination using one or a combination of the methods described. To prevent future field workers from getting confused, the method should be explained. If for example, sex ratios are given without further details of techniques used to sex them, they are not comparable and thus are of little scientific value.

LITERATURE CITED

AGRAWAL, J. C. 1954. Sexual dimorphism and eversion of the hemipenes in *Uromastyx hardwickii* Gray. *Agra Univ. J. Res. Sci.* 1954: 535-537.

AUFFENBERG, W. 1981. The Komodo monitor. University Press of Florida, Gainesville. x + 406 pp.

_____. 1994. The Bengal monitor. University Press of Florida, Gainesville. xxvii + 560 pp.

BENNETT, D. 1995. A little book of monitor lizards. Viper Press, Aberdeen. 208 pp + 18 col. pl.

BISWAS, S. & S. K. KAR. 1981. Some observations on nesting habits and biology of *Varanus salvator* (Laurenti) of Bhitarkanika Sanctuary, Orissa. *J. Bombay nat. Hist. Soc.* 78: 303-308.

CARPENTER, C. C. & G. W. FERGUSON. 1977. Variation and evolution of stereotyped behavior in reptiles. *In*: Biology of the Reptilia. Vol. 7A (Ecology and behavior). pp: 335-554. C. Gans & D. W. Tinkle (Eds.) Academic Press, New York & London.

DAVIS, R. B. & L. G. PHILLIPS. 1991. A method of sexing the Dumeril´s monitor, *Varanus dumerilii*. *Herpetol. Rev.* 22: 18-19.

DERANIYAGALA, R. Y. 1957. Pseudocombat of the monitor lizard *Varanus bengalensis* (Daudin). *Spolia Zeylanica* 28: 11-13.

GAULKE, M. 1989. Zur Biologie des Bindenwaranes, unter besonderer Berücksichtigung der paläogeographischen Verbreitung und der phylogenetischen Entwicklung der Varanidae. *Cour. Forsch.-Inst. Senckenberg.* 112: 1-242.

GREEN, B. & D. KING. 1993. Goanna. The biology of varanid lizards. New South Wales Univ. Press, Kensington. 102 pp.

HONEGGER, R. E. 1978. Geschlechtsbestimmung bei Reptilien. *Salamandra* 14: 69-79.

HORN, H.-G. 1980. Bisher unbekannte Details zur Kenntnis von *Varanus varius* auf Grund von feldherpetologischen und terraristischen Beobachtungen (Reptilia: Sauria: Varanidae). *Salamandra* 16: 1-18.

_____ , M. GAULKE & W. BÖHME. 1994. New data on ritualized combats in monitor lizards (Sauria: Varanidae), with remarks on their function and phylogenetic implications. *Zool. Garten N. F.* 64: 265-280.

KHAN, M. 1969. A preliminary study of the water monitor, *Varanus salvator. Malay. Nat. J.* 22: 64-68.

LASZLO, J. 1975. Probing as a practical method of sex recognition in snakes. *Int. Zoo Yrbk.* 15: 178-179.

MERTENS, R. 1942a. Die Familie der Warane (Varanidae). Erster Teil: Allgemeines. *Abh. Naturf. Ges.* 462: 1-116.

_____ . 1942b. Die Familie der Warane (Varanidae). Dritter Teil: Taxonomie. *Abh. Naturf. Ges.* 466: 235-391.

WHITAKER, R. & M. A. R. KHAN. 1982. Monitor lizards, identity and sexing problems. *Hamadryad* 7(2): 8-10.

WORRELL, E. 1963. Reptiles of Australia. Angus and Robertson, Sydney. xv + 270 pp.

YADAV, A. K. & K. S. RANA. 1988. Sexual dimorphism in the Indian monitor lizard *Varanus bengalensis* (Daudin). *Geobios New Rep.* 15: 210-214.

ZIEGLER, T. 1996. Zur Genitalmorphologie der varanoiden Reptilien (Sauria: Squamata: Platynota) unter besonderer Berücksichtigung der Hemiclitoris. Unpublished Masters Thesis. University of Bonn. 246 pp.

_____& W. BÖHME. 1996. Zur Hemiclitoris der squamaten Reptilien: Auswirkungen auf einige Methoden der Geschlechtsunterscheidung. *Herpetofauna, Weinstadt* 18(101): 11-19.

_____& W. BÖHME. In press. On the occurrence and variation of the hemiclitoris in squamate reptiles. *Proc. 8th O.G.M. Soc. European Herpetol. Bonn.*

Accepted: 11 June, 1997.

CHECKLIST OF THE REPTILES OF INDIA WITH ENGLISH COMMON NAMES

Indraneil Das

Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4,
Mamallapuram, Tamil Nadu 603 104, India

ABSTRACT.- An updated checklist of reptiles (species and subspecies) recorded from the Republic of India is presented, along with their authorities and a suggested common name. The list is significantly larger than those being currently used for biodiversity estimates of this fauna, containing 484 species, of which 182 (37.6 per cent) are endemic.

KEY WORDS.- Reptiles, checklist, English common names, biodiversity, India.

INTRODUCTION

Although the works of Malcolm Arthur Smith (1935-45) continue to be the last authoritative word on the reptile fauna of India, this fauna has seen a dramatic increase in the number of species, as a result of new species descriptions, revision of several groups, raising of a number of subspecies to the rank of species and the records of the occurrence of taxa earlier reported from neighbouring countries within the political boundary of India.

An 'in preparation' work on a checklist of the reptiles of India (also containing synonyms, information on types and taxonomic remarks) shows 484 species, which is significantly different from the information generally available. It was thus thought that a simple interim working checklist would aid workers in herpetology, as well as those who require this information for biodiversity assessments.

This work differs from an earlier one (Das, 1994) in containing names of species that are only found within Indian limits. It also incorporates new name changes, includes all new species described and attempts at standardization of the English common names of all Indian reptiles. A few errors concerning names of authorities, as well as omissions, have been corrected.

As of the cut off date (15 May, 1997), the total number of reptiles species known from the territory of India was 484, which includes 182 endemic species (37.6 per cent of total). If species endemic to the south Asian region (including Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka) are considered, the endemicity rate for the Indian region would increase substantially.

CROCODYLIDAE

1. *Crocodylus palustris* Lesson, 1831: Mugger crocodile
2. *Crocodylus porosus* Schneider, 1801: Saltwater crocodile

GAVIALIIDAE

3. *Gavialis gangeticus* (Gmelin, 1789): Gharial

DERMOCHELYIDAE

4. *Dermochelys coriacea* (Vandelli, 1761): Leatherback sea turtle

CHELONIIDAE

5. *Caretta caretta* (Linnaeus, 1758): Loggerhead sea turtle
   Caretta caretta gigas (Deraniyagala, 1933): Pacific loggerhead sea turtle
6. *Chelonia mydas* (Linnaeus, 1758): Green turtle
7. *Eretmochelys imbricata* (Linnaeus, 1766): Hawksbill sea turtle
8. *Lepidochelys olivacea* (Eschscholtz, 1829): Olive ridley sea turtle

BATAGURIDAE

9. *Batagur baska* (Gray in: Gray & Hardwicke, 1830. "1830-1835"): River terrapin
   Batagur baska baska (Gray, 1830): Common river terrapin

10. *Cuora amboinensis* (Daudin, 1801 "1802"): Southeast Asian box turtle
    Cuora amboinensis kamaroma Rummler & Fritz, 1991: Domed Malayan box turtle
11. *Cyclemys dentata* (Gray, 1831): Asian leaf turtle
12. *Geoclemys hamiltonii* (Gray, 1831): Spotted pond turtle
13. *Geoemyda silvatica* Henderson, 1912: Cochin forest cane turtle
14. *Hardella thurjii* (Gray, 1831): Crowned river turtle
    Hardella thurjii thurjii (Gray, 1831): Eastern crowned river turtle
15. *Kachuga dhongoka* (Gray in: Gray and Hardwicke, 1832): Three-striped roofed turtle
16. *Kachuga kachuga* (Gray in: Gray & Hardwicke, 1831): Red-crowned roofed turtle
17. *Kachuga smithii* (Gray, 1863): Brown roofed turtle
    Kachuga smithii smithii (Gray, 1863): Common brown roofed turtle
    Kachuga smithii pallidipes Moll, 1987: Pale-footed brown roofed turtle
18. *Kachuga sylhetensis* (Jerdon, 1870): Assam roofed turtle
19. *Kachuga tecta* (Gray, 1831): Indian roofed turtle
20. *Kachuga tentoria* (Gray, 1834): Indian tent turtle
    Kachuga tentoria tentoria (Gray, 1834): Peninsular tent turtle
    Kachuga tentoria circumdata Mertens, 1969: Pink-ringed tent turtle
    Kachuga tentoria flaviventer (Günther, 1864): Yellow-bellied tent turtle
21. *Melanochelys tricarinata* (Blyth, "1855" 1856): Tricarinate hill turtle
22. *Melanochelys trijuga* (Schweigger, 1812): Indian black turtle
    Melanochelys trijuga trijuga (Schweigger, 1812): Peninsular black turtle
    Melanochelys trijuga coronata (Anderson, "1878" 1879): Malabar black turtle
    Melanochelys trijuga indopeninsularis (Annandale, 1913): Eastern black turtle
    Melanochelys trijuga parkeri Deraniyagala, 1939: Sri Lankan black turtle
    Melanochelys trijuga thermalis (Lesson, 1830): Red-spotted black turtle
23. *Morenia petersi* (Anderson, "1878" 1879): Indian eyed turtle
24. *Pyxidea mouhotii* (Gray, 1862): Keeled box turtle

TESTUDINIDAE

25. *Geochelone elegans* (Schoepff, 1795): Indian star tortoise
26. *Indotestudo elongata* (Blyth, 1853): Elongated tortoise
27. *Indotestudo forstenii* (Schlegel & Müller in: Temminck, 1844): Travancore tortoise
28. *Manouria emys* (Schlegel & Müller in: Temminck, 1844): Asian Brown Tortoise
    Manouria emys phayrei (Blyth, 1853): Burmese black tortoise

TRIONYCHIDAE

29. *Aspideretes gangeticus* (Cuvier, 1825): Indian softshell turtle
30. *Aspideretes hurum* (Gray, 1831): Indian peacock softshell turtle
31. *Aspideretes leithii* (Gray, 1872): Leith's softshell turtle
32. *Chitra indica* (Gray in: Griffith & Pidgeon, 1831): Narrow-headed softshell turtle
33. *Lissemys punctata* (Bonnaterre, 1789): Indian flapshell turtle
    Lissemys punctata punctata (Bonnaterre, 1789): South Indian flapshell turtle
    Lissemys punctata andersoni Webb, 1980: North Indian flapshell turtle
34. *Pelochelys cantorii* Gray, 1864: Asian giant softshell turtle

EUBLEPHARIDAE

35. *Eublepharis hardwickii* Gray in: Hardwicke & Gray, 1827: East Indian leopard gecko
36. *Eublepharis macularius* (Blyth, 1854): Common leopard gecko

GEKKONIDAE

37. *Alsophylax boehmi* Szczerbak, 1991: Böhme's mountain gecko
38. *Calodactylodes aureus* (Beddome, 1870): Indian golden gecko

39. *Cnemaspis beddomei* (Theobald, 1876): Beddome's day gecko
40. *Cnemaspis boiei* (Gray, 1842): Boie's day gecko
41. *Cnemaspis goaensis* Sharma, 1976: Goan day gecko
42. *Cnemaspis gracilis* (Beddome, 1870): Slender day gecko
43. *Cnemaspis indica* (Gray, 1846): Indian day gecko
44. *Cnemaspis jerdonii* (Theobald, 1868): Jerdon's day gecko
    Cnemaspis jerdonii jerdonii (Theobald, 1868): Jerdon's day gecko
45. *Cnemaspis kandianus* (Kelaart, 1852): Kandy day gecko
46. *Cnemaspis littoralis* (Jerdon, 1853): Coastal day gecko
47. *Cnemaspis mysoriensis* (Jerdon, 1853): Mysore day gecko
48. *Cnemaspis nairi* Inger, Marx & Koshy, 1984: Ponmudi day gecko
49. *Cnemaspis ornatus* (Beddome, 1870): Ornate day gecko
50. *Cnemaspis sisparensis* (Theobald, 1876): Sispara day gecko
51. *Cnemaspis tropidogaster* (Boulenger, 1885): Rough-bellied day gecko
52. *Cnemaspis wynadensis* (Beddome, 1870): Wynad day gecko
53. *Cosymbotus platyurus* (Schneider, 1792): Flat-tailed gecko
54. *Cyrtodactylus fasciolatus* (Blyth, 1860): Banded bent-toed gecko
55. *Cyrtodactylus gubernatoris* (Annandale, 1913): Sikkimese bent-toed gecko
56. *Cyrtodactylus himalayanus* Duda & Sahi, 1978: Himalayan bent-toed gecko
57. *Cyrtodactylus khasiensis* (Jerdon, 1870): Khasi Hills bent-toed gecko
    Cyrtodactylus khasiensis khasiensis (Jerdon, 1870): Eastern bent-toed gecko
58. *Cyrtodacylus lawderanus* (Stoliczka, 1871): Lawder's bent-toed gecko
59. *Cyrtodactylus malcolmsmithi* (Constable, 1949): Smith's bent-toed gecko
60. *Cyrtodactylus mansarulus* Duda & Sahi, 1978: Jammu bent-toed gecko
61. *Cyrtodactylus pulchellus* (Gray, 1828): Beautiful bent-toed gecko
62. *Cyrtodactylus rubidus* (Blyth, 1860): Andamans bent-toed gecko
63. *Cyrtodactylus stoliczkai* (Steindachner, 1867): Karakoram bent-toed gecko
64. *Cyrtodactylus walli* (Ingoldby, 1922): Wall's bent-toed gecko
65. *Cyrtopodion baturensis* (Khan & Baig, 1992): Batur rock gecko
66. *Cyrtopodion kachhensis* (Stoliczka, 1872): Warty rock gecko
67. *Cyrtopodion scaber* (Heyden in: Rüppell, 1827): Keeled rock gecko
68. *Geckoella collegalensis* (Beddome, 1870): Kollegal ground gecko
69. *Geckoella dekkanensis* (Günther, 1864): Deccan ground gecko
70. *Geckoella jeyporensis* (Beddome, 1877): Jaipore ground gecko
71. *Geckoella nebulosa* (Beddome, 1870): Clouded ground gecko
72. *Gehyra mutilata* (Wiegmann, 1834): Four-clawed gecko
73. *Gekko gecko* (Linnaeus, 1758): Tokay gecko
    Gekko gecko gecko (Linnaeus, 1758): Common tokay gecko
74. *Gekko smithii* (Gray, 1842): Smith's giant gecko
75. *Gekko verreauxi* (Tytler, 1864): Andamans giant gecko
76. *Hemidactylus anamallensis* (Günther, 1875): Anaimalai gecko
77. *Hemidactylus bowringii* (Gray, 1845): Bowring's gecko
78. *Hemidactylus brookii* Gray, 1845: Brook's house gecko
    Hemidactylus brookii brookii (Gray, 1845): Brook's house gecko
79. *Hemidactylus flaviviridis* Rüppell, 1840: Yellow-green house gecko
80. *Hemidactylus frenatus* Schlegel in: Duméril & Bibron, 1836: Asian house gecko
81. *Hemidactylus garnotii* Duméril & Bibron, 1836: Garnot's gecko
82. *Hemidactylus giganteus* Stoliczka, 1871: Giant south Indian gecko

83. *Hemidactylus gracilis* Blanford, 1870: Slender gecko
84. *Hemidactylus karenorum* (Theobald, 1868): Karen gecko
85. *Hemidactylus leschenaultii* Duméril & Bibron, 1836: Bark gecko
86. *Hemidactylus maculatus* Duméril & Bibron, 1836: Spotted house gecko
    Hemidactylus maculatus maculatus Duméril & Bibron, 1836: Northern spotted gecko
    Hemidactylus maculatus hunae Deraniyagala, 1937: Southern spotted gecko
87. *Hemidactylus mahendrai* Shukla, 1983: Mahendra's gecko
88. *Hemidactylus porbandarensis* Sharma, 1981: Porbandar gecko
89. *Hemidactylus prashadi* Smith, 1935: Prashad's gecko
90. *Hemidactylus reticulatus* Beddome, 1870: Reticulated gecko
91. *Hemidactylus scabriceps* (Annandale, 1906): Scaly gecko
92. *Hemidactylus subtriedrus* Jerdon, 1853: Jerdon's gecko
93. *Hemidactylus triedrus* (Daudin, 1802): Termite hill gecko
    Hemidactylus triedrus triedrus (Daudin, 1802): Indian termite hill gecko
94. *Hemiphyllodactylus typus* Bleeker, 1860: Oriental worm gecko
    Hemiphyllodactylus typus typus Bleeker, 1860: Common worm gecko
    Hemiphyllodactylus typus aurantiacus Beddome, 1870: Western Ghats worm gecko
95. *Lepidodactylus lugubris* (Duméril & Bibron, 1836): Mourning gecko
96. *Phelsuma andamanense* Blyth, 1860: Andaman day gecko
97. *Ptychozoon kuhli* Stejneger, 1902: Kuhl's gliding gecko
98. *Teratolepis albofasciatus* (Grandison & Soman, 1963): White-banded broad-tailed gecko

AGAMIDAE

99. *Bronchocela cristatella* (Kuhl, 1820): Green crested lizard
100. *Bronchocela danieli* (Tiwari & Biswas, 1973): Daniel's forest lizard
101. *Bronchocela jubata* Duméril & Bibron, 1837: Maned forest lizard
102. *Bufoniceps laungwalansis* (Sharma, 1978): Laungwala toad-headed lizard
103. *Calotes andamanensis* Boulenger, 1891: Green crestless forest lizard
104. *Calotes calotes* (Linnaeus, 1758): Common green forest lizard
105. *Calotes ellioti* Günther, 1864: Elliot's forest lizard
    Calotes ellioti ellioti Günther, 1864: Elliot's forest lizard
    Calotes ellioti amarambalamensis Murthy, 1978: Amarambalam forest lizard
106. *Calotes emma* Gray, 1845: Emma Gray's forest lizard
    Calotes emma alticristatus Schmidt, 1927: High-crested forest lizard
107. *Calotes grandisquamis* Günther, 1875: Large-scaled forest lizard
108. *Calotes jerdoni* Günther, "1870" 1871: Jerdon's forest lizard
109. *Calotes maria* Gray, 1845: Khasi Hills forest lizard
110. *Calotes mystaceus* Duméril & Bibron, 1837: Moustached forest lizard
111. *Calotes nemoricola* Jerdon, 1853: Nilgiri forest lizard
112. *Calotes rouxii* Duméril & Bibron, 1837: Roux's forest lizard
113. *Calotes versicolor* (Daudin, 1802): Indian garden lizard
    Calotes versicolor versicolor (Daudin, 1802): Eastern garden lizard
114. *Coryphophylax subcristatus* (Blyth, 1860): Bay Islands forest lizard
115. *Draco blanfordii* Boulenger, 1885: Blanford's flying lizard
    Draco blanfordii norvilli (Alcock, 1895): Norvill's flying lizard
116. *Draco dussumieri* Duméril & Bibron, 1837: Western Ghats flying lizard
117. *Japalura andersoniana* Annandale, 1905: Anderson's mountain lizard
118. *Japalura kumaonensis* (Annandale, 1907): Kumaon mountain lizard

119. *Japalura major* (Jerdon, 1870): Large mountain lizard
120. *Japalura planidorsata* Jerdon, 1870: Smooth-scaled mountain lizard
121. *Japalura tricarinatus* (Blyth, 1853): Three-keeled mountain lizard
122. *Japalura variegata* Gray, 1853: Variegated mountain lizard
123. *Laudakia agrorensis* (Stoliczka, 1872): Agror agama
124. *Laudakia caucasicus* (Eichwald, 1831): Caucasian agama
125. *Laudakia himalayanus* (Steindachner, 1867): Himalayan agama
Laudakia himalayana himalayana (Steindachner, 1867)
126. *Laudakia melanura* Blyth, 1854: Black agama
127. *Laudakia minor* (Hardwicke & Gray, 1827): Lesser agama
128. *Laudakia pakistanica* (Baig, 1989): Pakistani agama
Laudakia pakistanica pakistanica (Baig, 1989): Pakistani agama
129. *Laudakia tuberculata* (Hardwicke & Gray, 1827): Kashmir rock agama
130. *Mictopholis austeniana* (Annandale, 1908): Abor Hills agama
131. *Oriocalotes paulus* Smith, 1935: Small forest lizard
132. *Otocryptis beddomii* Boulenger, 1885: Indian kangaroo lizard
133. *Phrynocephalus alticola* Peters, 1984: Montane toad-headed agama
134. *Phrynocephalus euptilopus* Alcock & Finn, "1896" 1897: Alcock's toad-headed agama
135. *Phrynocephalus luteoguttatus* Boulenger, 1887: Yellow-speckled toad-headed agama
136. *Phrynocephalus reticulatus* Eichwald, 1831: Reticulated toad-headed agama
137. *Phrynocephalus theobaldi* Blyth, 1863: Theobald's toad-headed agama
138. *Psammophilus blanfordanus* (Stoliczka, 1871): Blanford's rock agama
139. *Psammophilus dorsalis* (Gray in: Griffith & Pidgeon, 1831): South Indian rock agama
140. *Pseudocalotes microlepis* (Boulenger, 1887): Burmese false blood-sucker
141. *Ptyctolaemus gularis* (Peters, 1864): Green fan-throated lizard
142. *Salea anamallayana* (Beddome, 1878): Anaimalai spiny lizard
143. *Salea horsfieldii* Gray, 1845: Horsfield's spiny lizard
144. *Salea kakhienensis* (Anderson, "1878" 1879): Kakhyen hills spiny lizard
145. *Sitana ponticeriana* Cuvier, 1844: Fan-throated lizard
146. *Trapelus agilis* (Olivier, 1804): Brilliant ground agama
147. *Uromastyx hardwickii* Gray in: Hardwicke & Gray, 1827: Hardwick's spiny-tailed lizard

CHAMAELEONIDAE

148. *Chamaeleo zeylanicus* Laurenti, 1768: Indian chamaeleon

DIBAMIDAE

149. *Dibamus nicobaricum* (Fitzinger in: Steindachner, 1867): Nicobarese worm lizard

SCINCIDAE

150. *Ablepharus grayanus* (Stoliczka, 1872): Dwarf earless skink
151. *Ablepharus pannonicus* Fitzinger in: Lichtenstein in: Eversmann, 1823: Mediterranean dwarf skink
152. *Barkudia insularis* Annandale, 1917: Barkud Island limbless skink
153. *Chalcides pentadactylus* (Beddome, 1870): Five-toed skink
154. *Dasia halianus* (Haly & Nevill in: Nevill, 1887): Haly's tree skink
155. *Dasia nicobarensis* Biswas & Sanyal, 1977: Nicobarese tree skink
156. *Dasia olivacea* Gray, 1839: Olive tree skink
157. *Dasia subcaeruleum* (Boulenger, 1891): Blue-bellied tree skink
158. *Eumeces blythianus* (Anderson, 1871): Blyth's mole skink
159. *Eumeces schneiderii* (Daudin, 1802): Orange-tailed mole skink
Eumeces schneiderii schneiderii (Daudin, 1802): Indian mole skink

160. *Eumeces taeniolatus* (Blyth, 1854): Yellow-bellied mole skink
Eumeces taeniolatus taeniolatus (Blyth, 1854): Eastern yellow-bellied mole skink
161. *Lipinia macrotympanum* (Stoliczka, 1873): Small-eared island skink
162. *Lygosoma albopunctata* (Gray, 1846): White-spotted supple skink
163. *Lygosoma ashwamedhi* (Sharma, 1969): Ashwamedha supple skink
164. *Lygosoma bowringii* (Günther, 1864): Bowring's supple skink
165. *Lygosoma goaensis* (Sharma, 1976): Goan supple skink
166. *Lygosoma guentheri* (Peters, 1879): Günther's supple skink
167. *Lygosoma lineata* (Gray, 1839): Lined supple skink
168. *Lygosoma pruthi* (Sharma, 1977): Pruth's supple skink
169. *Lygosoma punctatus* (Gmelin, 1799): Spotted supple skink
170. *Lygosoma vosmaerii* (Gray, 1839): Vosmaer's supple skink
171. *Mabuya allapallensis* Schmidt, 1926: Allapalli grass skink
172. *Mabuya andamanensis* Smith, 1935: Andaman Islands grass skink
173. *Mabuya beddomei* (Jerdon, 1870): Beddome's grass skink
174. *Mabuya bibronii* (Gray, "1838" 1839): Bibron's seashore skink
175. *Mabuya carinata* (Schneider, 1801): Keeled grass skink
Mabuya carinata carinata (Schneider, 1801): Common keeled grass skink
176. *Mabuya clivicola* Inger, Shaffer, Koshy & Bakde, 1984: Mountain skink
177. *Mabuya dissimilis* (Hallowell, 1857): Striped grass skink
178. *Mabuya gansi* Das, 1991: Gans' grass skink
179. *Mabuya innotatus* (Blanford, 1870): Blanford's grass skink
180. *Mabuya macularius* (Blyth, 1853): Bronze grass skink
Mabuya macularius macularius (Blyth, 1853): Eastern bronze skink
181. *Mabuya multifasciata* (Kuhl, 1820): Many-lined grass skink
182. *Mabuya nagarjuni* Sharma, 1969: Nagarjunsagar grass skink
183. *Mabuya novemcarinata* (Anderson, 1871): Nine-keeled grass skink
184. *Mabuya quadricarinata* (Boulenger, 1887): Four-keeled grass skink
185. *Mabuya rudis* Boulenger, 1887: Lined grass skink
186. *Mabuya rugifera* (Stoliczka, 1870): Rough-scaled skink
187. *Mabuya trivittata* (Hardwicke & Gray, 1827): Three-lined grass skink
188. *Mabuya tytlerii* (Tytler in: Theobald, 1868): Tytler's grass skink
189. *Ophiomorus raithmai* Anderson & Leviton, 1966: Eastern sand-swimmer
190. *Ophiomorus tridactylus* (Blyth, 1853): Indian sand-swimmer
191. *Ristella beddomii* Boulenger, 1887: Beddome's cat skink
192. *Ristella guentheri* Boulenger, 1887: Günther's cat skink
193. *Ristella rurkii* Gray, 1839: Rurk's cat skink
194. *Ristella travancoricus* (Beddome, 1870): Travancore cat skink
195. *Scincella bilineatum* (Gray, 1846): Two-lined ground skink
196. *Scincella himalayanus* (Günther, 1864): Himalayan ground skink
197. *Scincella ladacensis* (Günther, 1864): Mountain ground skink
198. *Scincella macrotis* (Fitzinger in: Steindachner, 1867): Large-eared ground skink
199. *Scincella sikimmensis* (Blyth, 1853): Sikkimese ground skink
200. *Scincella tragbulense* (Alcock, 1898): Tragbul ground skink
201. *Scincella travancoricum* (Beddome, 1870): Travancore ground skink
202. *Sepsophis punctatus* Beddome, 1870: Spotted Eastern Ghats skink
203. *Sphenomorphus courcyanum* (Annandale, 1912): Rotung litter skink
204. *Sphenomorphus dussumieri* (Duméril & Bibron, 1839): Dussumier's litter skink

205. *Sphenomorphus indicus* (Gray, 1853): Himalayan litter skink
206. *Sphenomorphus maculatus* (Blyth, 1853): Spotted litter skink
207. *Sphenomorphus reevesii* (Gray, "1838" 1839): Reeves' litter skink
Sphenomorphus reevesii reevesii (Gray, 1838): Reeves' eastern litter skink

LACERTIDAE

208. *Acanthodactylus blanfordii* Boulenger, 1918: Mekran fringe-toed lizard
209. *Acanthodactylus cantoris* Günther, 1864: Indian fringe-toed lizard
210. *Eremias guttulata* (Lichtenstein, 1823): Desert lacerta
211. *Ophisops beddomei* (Jerdon, 1870): Beddome's lacerta
212. *Ophisops jerdoni* Blyth, 1853: Snake-eyed lacerta
213. *Ophisops leschenaultii* (Milne-Edwards, 1829): Leschenault's lacerta
Ophisops leschenaultii leschenaultii (Milne-Edwards, 1829):
214. *Ophisops microlepis* (Blanford, 1870): Small-scaled lacerta
215. *Ophisops minor* (Deraniyagala, 1971): Striped lacerta
Ophisops minor nictans Arnold, 1989: Indian dwarf lacerta
216. *Takydromus haughtonianus* (Jerdon, 1870): Haughton's long-tailed lizard
217. *Takydromus sexlineatus* Daudin, 1802: Six-lined long-tailed lizard
Takydromus sexlineatus khasiensis (Boulenger, 1917): Khasi Hills long-tailed lizard

ANGUIDAE

218. *Ophisaurus gracilis* (Gray, 1845): Indian glass snake

VARANIDAE

219. *Varanus bengalensis* (Daudin, 1802): Bengal monitor
220. *Varanus flavescens* (Hardwicke & Gray, 1827): Yellow monitor
221. *Varanus griseus* (Daudin, 1803): Desert monitor
*Varanus griseus koniczny*i Mertens, 1954: Eastern desert monitor
222. *Varanus salvator* (Laurenti, 1768): Water monitor
Varanus salvator salvator (Laurenti, 1768): Common water monitor
Varanus salvator andamanensis Deraniyagala, 1944: Andaman water monitor
Varanus salvator macromaculatus Deraniyagala, 1944: Southeast Asian water monitor
Varanus salvator nicobariensis Deraniyagala, 1947: Nicobar water monitor

LEPTOTYPHLOPIDAE

223. *Leptotyphlops blanfordii* (Boulenger, 1890): Sindh thread snake
Leptotyphlops blanfordii blanfordii (Boulenger, 1890): Blanford's thread snake
224. *Leptotyphlops macrorhynchus* (Jan in: Jan & Sordelli, 1860): Large-beaked thread snake

TYPHLOPIDAE

225. *Ramphotyphlops braminus* (Daudin, 1803): Brahminy worm snake
226. *Rhinotyphlops acutus* (Duméril, Bibron & Duméril, 1844): Beaked worm
227. *Typhlops andamanensis* Stoliczka, 1871: Andaman worm snake
228. *Typhlops beddomei* Boulenger, 1890: Beddome's worm snake
229. *Typhlops bothriorhynchus* Günther, 1864: Assam worm snake
230. *Typhlops diardii* Schlegel, 1839: Large worm snake
Typhlops diardii diardii Schlegel, 1839: Western large worm snake
231. *Typhlops exiguus* Jan in: Jan & Sordelli, 1864: Jan's worm snake
232. *Typhlops jerdoni* Boulenger, 1890: Jerdon's worm snake
233. *Typhlops loveridgei* Constable, 1949: Loveridge's worm snake
234. *Typhlops oatesii* Boulenger, 1890: Oates' worm snake

235. *Typhlops oligolepis* Wall, 1909: Wall's worm snake
236. *Typhlops pammeces* Günther, 1864: Günther's worm snake
237. *Typhlops porrectus* Stoliczka, 1871: Slender blind snake
238. *Typhlops tenuicollis* (Peters, 1864): Slender-necked worm snake
239. *Typhlops thurstoni* Boettger, 1890: Thurston's worm snake
240. *Typhlops tindalli* Smith, 1943: Tindall's worm snake

UROPELTIDAE

241. *Brachyophidium rhodogaster* Wall, 1921: Red-bellied shieldtail
242. *Melanophidium bilineatum* Beddome, 1870: Yellow-striped shieldtail
243. *Melanophidium punctatum* Beddome, 1871: Pied-belly shieldtail
244. *Melanophidium wynaudensis* (Beddome, 1863): Wynaad shieldtail
245. *Platyplectrurus madurensis* Beddome, 1877: Madurai shieldtail
246. *Platyplectrurus trilineatus* (Beddome, 1867): Three-lined shieldtail
247. *Plectrurus aureus* Beddome, 1880: Golden shieldtail
248. *Plectrurus canaricus* (Beddome, 1870): Kanara shieldtail
249. *Plectrurus guentheri* Beddome, 1863: Purple shieldtail
250. *Plectrurus perroteti* Duméril, Bibron & Duméril, 1854: Perrotet's shieldtail
251. *Rhinophis fergusonianus* Boulenger, 1896: Cardamom shieldtail
252. *Rhinophis sanguineus* Beddome, 1863: Red-bellied shieldtail
253. *Rhinophis travancoricus* Boulenger, 1892: Travancore shieldtail
254. *Teretrurus sanguineus* Beddome, 1867: Western shieldtail
255. *Uropeltis arcticeps* (Günther, 1875): Tirunelveli shieldtail
256. *Uropeltis beddomii* (Günther, 1862): Beddome's shieldtail
257. *Uropeltis broughami* (Beddome, 1878): Sirumalai shieldtail
258. *Uropeltis ceylanicus* Cuvier, 1829: Kerala shieldtail
259. *Uropeltis dindigalensis* (Beddome, 1877): Dindigul shieldtail
260. *Uropeltis ellioti* (Gray, 1858): Elliot's shieldtail
261. *Uropeltis liura* (Günther, 1875): Ashambu shieldtail
262. *Uropeltis macrolepis* (Peters, 1861): Large-scaled shieldtail
    Uropeltis macrolepis macrolepis (Peters, 1862): Bombay shieldtail
    Uropeltis macrolepis mahableshwarensis Chari, 1955: Mahableshwar shieldtail
263. *Uropeltis macrorhynchus* (Beddome, 1877): Anaimalai shieldtail
264. *Uropeltis maculatus* (Beddome, 1878): Red-sided shieldtail
265. *Uropeltis myhendrae* Beddome, 1886: Barred shieldtail
266. *Uropeltis nitidus* (Beddome, 1878): Cochin shieldtail
267. *Uropeltis ocellatus* (Beddome, 1863): Nilgiri shieldtail
268. *Uropeltis petersi* (Beddome, 1878): Peters' shieldtail
269. *Uropeltis phipsonii* (Mason, 1888): Phipson's shieldtail
270. *Uropeltis pulneyensis* (Beddome, 1863): Palni shieldtail
271. *Uropeltis rubrolineatus* (Günther, 1875): Red-lined shieldtail
272. *Uropeltis rubromaculatus* (Beddome, 1867): Red-spotted shieldtail
273. *Uropeltis smithi* Gans, 1966: Violet shieldtail
274. *Uropeltis woodmasoni* (Theobald, 1876): Black-bellied shieldtail

XENOPELTIDAE

275. *Xenopeltis unicolor* Reinwardt in: Boie, 1827. Common sunbeam snake

BOIDAE

276. *Eryx conica* (Schneider, 1801): Common sand boa
    Eryx conica conica (Schneider, 1801): Common sand boa

277. *Eryx johnii* (Russell, 1801): Red sand boa
Eryx johnii johnii (Russell, 1801): Eastern red sand boa
278. *Eryx whitakeri* Das, 1991: Whitaker's sand boa
279. *Python molurus* (Linnaeus, 1758): Indian rock python
Python molurus molurus (Linnaeus, 1758): Indian rock python
Python molurus bivittatus Kuhl, 1820: Burmese rock python
280. *Python reticulatus* (Schneider, 1801): Reticulated python

ACROCHORDIDAE

281. *Acrochordus granulatus* (Schneider, 1799): Western wart snake

COLUBRIDAE

282. *Ahaetulla dispar* (Günther, 1864): Günther's vine snake
283. *Ahaetulla fronticincta* (Günther, 1858): River vine snake
284. *Ahaetulla nasutus* (Andersson, 1898): Common vine snake
285. *Ahaetulla perroteti* (Duméril, Bibron & Duméril, 1854): Bronze-headed vine snake
286. *Ahaetulla prasina* (Reinwardt in: Boie, 1827): Oriental vine snake
Ahaetulla prasina prasina (Reinwardt in: Boie, 1827): North-eastern vine snake
287. *Ahaetulla pulverulenta* (Duméril, Bibron & Duméril, 1854): Brown vine snake
288. *Ahaetulla subocularis* (Boulenger, 1888): Myanmarese vine snake
289. *Amphiesma beddomii* (Günther, 1864): Beddome's keelback
290. *Amphiesma khasiensis* (Boulenger, 1890): Khasi Hills keelback
291. *Amphiesma modesta* (Günther, 1875): Günther's keelback
292. *Amphiesma monticola* (Jerdon, 1853): Montane keelback
293. *Amphiesma nicobariensis* (Sclater, 1891): Camorta keelback
294. *Amphiesma parallela* (Boulenger, 1890): Boulenger's keelback
295. *Amphiesma pealii* (Sclater, 1891): Peal's keelback
296. *Amphiesma platyceps* (Blyth, 1854): Eastern keelback
297. *Amphiesma sieboldii* (Günther, 1860): Siebold's keelback
298. *Amphiesma stolata* (Linnaeus, 1758): Buff-striped keelback
299. *Amphiesma xenura* (Wall, 1907): Cherrapunji keelback
300. *Argyrogena fasciolatus* (Shaw, 1802): Banded racer
301. *Atretium schistosum* (Daudin, 1803): Olive keelback water snake
302. *Blythia reticulata* (Blyth, 1854): Iridescent snake
303. *Boiga andamanensis* (Wall, 1909): Andamans cat snake
304. *Boiga beddomei* (Wall, 1909): Beddome's cat snake
305. *Boiga ceylonensis* (Günther, 1858): Sri Lankan cat snake
306. *Boiga cyanea* (Duméril, Bibron & Duméril, 1854): Green cat snake
307. *Boiga dightoni* (Boulenger, 1894): Travancore cat snake
308. *Boiga forsteni* (Duméril, Bibron & Duméril, 1854): Forstein's cat snake
309. *Boiga gokool* (Gray in: Gray & Hardwicke, 1835): Eastern cat snake
310. *Boiga multifasciata* (Blyth, "1860" 1861): Many-banded cat snake
311. *Boiga multomaculata* (Reinwardt in: Boie, 1827): Spotted cat snake
312. *Boiga nuchalis* (Günther, 1875): Collared cat snake
313. *Boiga ocellata* Kroon, 1973: Eyed cat snake
314. *Boiga ochraceus* (Günther, 1868): Tawny cat snake
Boiga ochraceus ochraceus (Günther, 1868): Common tawny cat snake
Boiga ochraceus stoliczkae (Wall, 1909): Stoliczka's tawny cat snake
Boiga ochraceus walli Smith, 1943: Wall's tawny cat snake
315. *Boiga quincunciata* (Wall, 1908): Assamese cat snake

316. *Boiga trigonatus* (Schneider in: Bechstein, 1802): Common Indian cat snake
317. *Calamaria pavimentata* Duméril, Bibron & Duméril, 1854: Indian reed snake
318. *Cantoria violacea* Cantor, 1839: Yellow-banded mangrove snake
319. *Cerberus rynchops* (Schneider, 1799): Dog-faced water snake
320. *Chrysopelea ornata* (Shaw, 1802): Ornate flying snake
Chrysopelea ornata ornata (Shaw, 1802): Indian ornate flying snake
Chrysopelea ornata ornatissima Werner, 1925: South-east Asian flying snake
321. *Chrysopelea paradisi* H. Boie in: F. Boie, 1827: Red-spotted flying snake
Chrysopelea paradisi paradisi H. Boie in: F. Boie, 1827: Red-spotted flying snake
322. *Coluber bholanathi* Sharma, 1976: Nagarjun Sagar racer
323. *Coluber gracilis* (Günther, 1862): Slender racer
324. *Coluber ravergieri* Ménétriés, 1832: Mountain racer
Coluber ravergieri ladacensis Anderson, 1871: Eastern mountain racer
325. *Coluber rhodorachis* (Jan in: De Filippi, 1865): Cliff racer
326. *Coluber ventromaculatus* Gray, 1834: Glossy-bellied racer
327. *Coronella brachyura* (Günther, 1866): Indian smooth snake
328. *Cyclophiops doriae* (Boulenger, 1888): Green snake
329. *Dendrelaphis cyanochloris* (Wall, 1921): Blue bronzeback tree snake
330. *Dendrelaphis gorei* (Wall, 1910): Himalayan bronzeback tree snake
331. *Dendrelaphis grandoculis* (Boulenger, 1890): Large-eyed bronzeback tree snake
332. *Dendrelaphis humayuni* Tiwari & Biswas, 1973: Nicobarese bronzeback tree snake
333. *Dendrelaphis pictus* (Gmelin, 1789): Painted bronzeback tree snake
Dendrelaphis pictus pictus (Gmelin, 1789): Common painted bronzeback tree snake
Dendrelaphis pictus andamanensis (Anderson, 1871): Andamanese painted bronzeback tree snake
334. *Dendrelaphis tristis* (Daudin, 1803): Common bronzeback tree snake
335. *Dinodon gammiei* (Blanford, 1878): Sikkim false wolf snake
336. *Dinodon septentrionalis* (Günther, 1875): Günther's false wolf snake
337. *Dryocalamus gracilis* (Günther, 1864): Slender bridal snake
338. *Dryocalamus nympha* (Daudin, 1803): Common bridal snake
339. *Elachistodon westermanni* Reinhardt, 1863: Indian egg-eating snake
340. *Elaphe cantoris* (Boulenger, 1894): Eastern trinket snake
341. *Elaphe flavolineata* (Schlegel, 1837): Yellow-striped trinket snake
342. *Elaphe helena* (Daudin, 1803): Indian trinket snake
Elaphe helena helena (Daudin, 1803): Common Indian trinket snake
Elaphe helena monticollaris Schulz, 1992: Montane trinket snake
343. *Elaphe hodgsonii* (Günther, 1860): Himalayan trinket snake
344. *Elaphe mandarina* (Cantor, 1842): Mandarin trinket snake
345. *Elaphe porphyracea* (Cantor, 1839): Black-banded trinket snake
Elaphe porphyracea porphyracea (Cantor, 1839): Western black-banded trinket snake
346. *Elaphe radiata* (Schlegel, 1837): Copper-headed trinket snake
347. *Elaphe taeniura* (Cope, "1860" 1861): Striped trinket snake
Elaphe taeniura yunnanensis Anderson, "1878" 1879: Yunnanese striped trinket snake
348. *Enhydris dussumierii* (Duméril, Bibron & Duméril, 1854): Dussumier's smooth water snake
349. *Enhydris enhydris* (Schneider, 1799): Common smooth water snake
350. *Enhydris sieboldii* Schlegel, 1837: Siebold's smooth water snake

351. *Fordonia leucobalia* (Schlegel, 1837): White-bellied mangrove snake
352. *Gerarda prevostianus* (Eydoux & Gervais, 1837): Glossy marsh snake
353. *Gongylosoma nicobariensis* (Stoliczka, 1870): Camorta Island stripe-necked snake
354. *Gonyosoma frenatum* (Gray, 1853): Khasi Hills trinket snake
355. *Gonyosoma oxycephalum* (Reinwardt in: F. Boie, 1827): Red-tailed trinket snake
356. *Gonyosoma prasina* (Blyth, 1854): Green trinket snake
357. *Homalopsis buccata* (Linnaeus, 1758): Puff-faced water snake
358. *Liopeltis frenatus* (Günther, 1858): Stripe-necked snake
359. *Liopeltis rappii* (Günther, 1860): Himalayan stripe-necked snake
360. *Liopeltis stoliczkae* (Sclater, 1891): Stoliczka's stripe-necked snake
361. *Lycodon aulicus* (Linnaeus, 1758): Common wolf snake
362. *Lycodon capucinus* Boie, 1827: Island wolf snake
363. *Lycodon fasciatus* (Anderson, "1878" 1879): Banded wolf snake
364. *Lycodon flavomaculatus* Wall, 1907: Yellow-spotted wolf snake
365. *Lycodon jara* (Shaw, 1802): Yellow-speckled wolf snake
366. *Lycodon laoensis* Günther, 1864: Laotian wolf snake
367. *Lycodon mackinnoni* Wall, 1906: Mackinnon's wolf snake
368. *Lycodon striatus* (Shaw, 1802): Barred wolf snake
Lycodon striatus striatus (Shaw, 1802): Northern barred wolf snake
369. *Lycodon tiwarii* Biswas & Sanyal, 1965: Tiwari's wolf snake
370. *Lycodon travancoricus* (Beddome, 1870): Travancore wolf snake
371. *Macropisthodon plumbicolor* (Cantor, 1839): Green keelback
Macropisthodon plumbicolor plumbicolor (Cantor, 1839): Indian green keelback
372. *Oligodon affinis* Günther, 1862: Western kukri snake
373. *Oligodon albocinctus* (Cantor, 1839): White-barred kukri snake
374. *Oligodon arnensis* (Shaw, 1802): Banded kukri snake
375. *Oligodon brevicaudus* Günther, 1862: Striped kukri snake
376. *Oligodon calamarius* (Linnaeus, 1758): Reed-like kukri snake
377. *Oligodon catenatus* (Blyth, 1854): North-eastern kukri snake
378. *Oligodon cinereus* (Günther, 1864): Black-barred kukri snake
379. *Oligodon cyclurus* (Cantor, 1839): Cantor's kukri snake
Oligodon cyclurus cyclurus (Cantor, 1839):
380. *Oligodon dorsalis* (Gray in: Gray & Hardwicke, 1835): Spot-tailed kukri snake
381. *Oligodon dorsolateralis* (Wall, 1909): Side-striped kukri snake
382. *Oligodon erythrogaster* Boulenger, 1907: Red-bellied kukri snake
383. *Oligodon erythrorhachis* Wall, 1910: Red-striped kukri snake
384. *Oligodon juglandifer* (Wall, 1909): Darjeeling kukri snake
385. *Oligodon melaneus* Wall, 1909: Black kukri snake
386. *Oligodon melazonotus* Wall, 1922: Wall's kukri snake
387. *Oligodon nikhili* Whitaker & Dattatri, 1982: Palni Hills kukri snake
388. *Oligodon taeniolatus* (Jerdon, 1853): Streaked kukri snake
Oligodon taeniolatus fasciatus (Günther, 1864): Indian streaked kukri snake
389. *Oligodon theobaldi* (Günther, 1868): Mandalay kukri snake
390. *Oligodon travancoricum* Beddome, 1877: Travancore kukri snake
391. *Oligodon venustum* (Jerdon, 1853): Black-spotted kukri snake
392. *Oligodon woodmasoni* (Sclater, 1891): Yellow-striped kukri snake
393. *Pareas macularius* Blyth in: Theobald, 1868: Darjeeling snail-eater
394. *Pareas monticolus* (Cantor, 1839): Assam snail-eater

395. *Psammodynastes pulverulentus* (H. Boie in: F. Boie, 1827): Mock viper
396. *Psammophis condanarus* (Merrem, 1820): Oriental sand snake
Psammophis condanarus condanarus (Merrem, 1820): Western sand snake
397. *Psammophis leithii* Günther, 1869: Pakistani ribbon snake
398. *Psammophis longifrons* Boulenger, 1890: Stout sand snake
399. *Psammophis schokari* (Forsskål, 1775): Afro-Asian sand snake
400. *Pseudoxenodon macrops* (Blyth, 1854): Large-eyed false cobra
Pseudoxenodon macrops macrops (Blyth, 1854): Western large-eyed false cobra
401. *Ptyas korros* (Schlegel, 1837): Eastern rat snake
402. *Ptyas mucosus* (Linnaeus, 1758): Western rat snake
Ptyas mucosus mucosus (Linnaeus, 1758): Indian rat snake
403. *Ptyas nigromarginatus* (Blyth, 1854): Green rat snake
404. *Rhabdophis himalayanus* (Günther, 1864): Himalayan keelback
405. *Rhabdophis subminiatus* (Schlegel, 1837): Red-necked keelback
406. *Rhabdops bicolor* (Blyth, 1854): Yellow-bellied forest snake
407. *Rhabdops olivaceus* (Beddome, 1863): Olive forest snake
408. *Sibynophis bistrigatus* (Günther, 1868): Pegu black-headed snake
409. *Sibynophis collaris* (Gray, 1853): Collared black-headed snake
410. *Sibynophis sagittaria* (Cantor, 1839): Cantor's black-headed snake
411. *Spalerosophis arenarius* (Boulenger, 1890): Red-spotted diadem snake
412. *Spalerosophis diadema* (Schlegel, 1837): Royal snake
Spalerosophis diadema diadema (Schlegel, 1837):
413. *Stoliczkia khasiensis* Jerdon, 1870: Khasi earth snake
414. *Trachischium fuscum* (Blyth, 1854): Darjeeling oriental slender snake
415. *Trachischium guentheri* Boulenger, 1890: Günther's oriental slender snake
416. *Trachischium laeve* Peracca, 1904: Olive oriental slender snake
417. *Trachischium monticolum* (Cantor, 1839): Assam oriental slender snake
418. *Trachischium tenuiceps* (Blyth, 1854): Orange-belted oriental slender snake
419. *Xenochrophis cerasogaster* (Cantor, 1839): Dark-bellied marsh snake
420. *Xenochrophis flavipunctatus* (Hallowell, "1860" 1861): Yellow-spotted keelback water snake
Xenochrophis flavipunctatus flavipunctatus (Hallowell, "1860" 1861): Eastern yellow-spotted keelback water snake
421. *Xenochrophis melanzostus* (Gravenhorst, 1807): Andamans keelback water snake
422. *Xenochrophis piscator* (Schneider, 1799): Checkered keelback water snake
423. *Xenochrophis punctulatus* (Günther, 1858): Spotted keelback water snake
424. *Xenochrophis sanctijohannis* (Boulenger, 1890): St. John's keelback water snake
425. *Xenochropis trianguligerus* (Boie, 1827): Triangle-backed water snake
426. *Xylophis perroteti* (Duméril, Bibron & Duméril, 1854): Striped narrow-headed snake
427. *Xylophis stenorhynchus* (Günther, 1875): Günther's narrow-headed snake

ELAPIDAE

428. *Bungarus andamanensis* Biswas & Sanyal, 1978: Andamans krait
429. *Bungarus bungaroides* (Cantor, 1839): Himalayan krait
430. *Bungarus caeruleus* (Schneider, 1801): Common Indian krait
431. *Bungarus fasciatus* (Schneider, 1801): Banded krait
432. *Bungarus lividus* Cantor, 1839: Lesser black krait
433. *Bungarus niger* Wall, 1909: Black krait
434. *Bungarus sindanus* Boulenger, 1897: Sind krait
Bungarus sindanus sindanus Boulenger, 1897: Common Sind krait

Bungarus sindanus walli Wall, 1907: Wall's krait

435. *Calliophis beddomei* (Smith, 1943): Beddome's coral snake
436. *Calliophis bibroni* (Jan, 1858): Bibron's coral snake
437. *Calliophis macclellandi* (Reinhardt, 1844): MacClelland's coral snake
Calliophis macclellandi macclellandi (Reinhardt, 1844): MacClelland's coral snake
Calliophis macclellandi univirgatus (Günther, 1858): One-lined MacClelland's coral snake
438. *Calliophis melanurus* (Shaw, 1802): Slender coral snake
Calliophis melanurus melanurus (Shaw, 1802): Common slender coral snake
Calliophis melanurus nigrescens Günther, 1862: Black slender coral snake
439. *Naja kaouthia* Lesson, 1831: Monocled cobra
440. *Naja naja* (Linnaeus, 1758): Spectacled cobra
441. *Naja oxiana* (Eichwald, 1831): Black cobra
442. *Naja sagittifera* Wall, 1913. Andaman cobra
443. *Ophiophagus hannah* (Cantor, 1836): King cobra

HYDROPHIIDAE

444. *Astrotia stokesii* (Gray in: Stokes, 1846): Large-headed sea snake
445. *Enhydrina schistosus* (Daudin, 1803): Hook-nosed sea snake
446. *Hydrophis caerulescens* (Shaw, 1802): Many-toothed sea snake
447. *Hydrophis cantoris* Günther, 1864: Cantor's narrow-headed sea snake
448. *Hydrophis cyanocinctus* Daudin, 1803: Annulated sea snake
449. *Hydrophis fasciatus* (Schneider, 1799): Banded sea snake
Hydrophis fasciatus fasciatus (Schneider, 1799):
450. *Hydrophis gracilis* (Shaw, 1802): Common small-headed sea snake
451. *Hydrophis lapemoides* (Gray, 1849): Persian Gulf sea snake
452. *Hydrophis mamillaris* (Daudin, 1803): Bombay sea snake
453. *Hydrophis nigrocinctus* Daudin, 1803: Black banded sea snake
454. *Hydrophis obscura* Daudin, 1803: Estuarine sea snake
455. *Hydrophis ornatus* (Gray, 1842): Cochin banded sea snake
Hydrophis ornatus ornatus (Gray, 1842): Ornate sea snake
456. *Hydrophis spiralis* (Shaw, 1802): Yellow sea snake
457. *Hydrophis stricticollis* Günther, 1864: Bengal sea snake
458. *Kerilia jerdonii* Gray, 1849: Jerdon's sea snake
Kerilia jerdonii jerdonii Gray, 1849:
459. *Lapemis curtus* Shaw, 1802: Short sea snake
460. *Laticauda laticaudata* (Linnaeus, 1758): Common sea krait
Laticauda laticaudata affinis Anderson, 1871: Western sea krait
461. *Laticauda colubrina* (Schneider, 1799): Yellow-lipped sea krait
462. *Pelamis platurus* (Linnaeus, 1766): Pelagic sea snake
463. *Thalassophis viperina* Schmidt, 1852: Viperine sea snake

VIPERIDAE

464. *Agkistrodon himalayanus* (Günther, 1864): Himalayan pit viper
465. *Daboia russelii* (Shaw & Nodder, 1797): Russell's viper
Daboia russelii russelii (Shaw & Nodder, 1797): Indian Russell's viper
466. *Echis carinatus* (Schneider, 1801): Indian saw-scaled viper
Echis carinatus carinatus (Schneider, 1801): South Indian saw-scaled viper
Echis carinatus sochureki Stemmler, 1969: Sochurek's saw-scaled viper
467. *Hypnale hypnale* (Merrem, 1820): Indian hump-nosed pit viper
468. *Ovophis monticola* (Günther, 1864): Blotched pit viper
Ovophis monticola monticola (Günther, 1864): Western blotched pit viper

469. *Protobothrops jerdonii* (Günther, 1875): Jerdon's pit viper
Protobothrops jerdonii jerdonii (Günther, 1875): India, Nepal
470. *Protobothrops mucrosquamatus* (Cantor, 1839): Brown spotted pit viper
471. *Pseudocerastes persica* (Duméril, Bibron & Duméril, 1854): Persian horned viper
Pseudocerastes persica persica (Duméril, Bibron & Duméril, 1854): Common Persian horned viper
472. *Trimeresurus albolabris* Gray, 1842: White-lipped pit viper
473. *Trimeresurus cantori* (Blyth, 1846): Cantor's pit viper
474. *Trimeresurus erythrurus* (Cantor, 1839): Spot-tailed pit viper
475. *Trimeresurus gramineus* (Shaw, 1802): Bamboo pit viper
476. *Trimeresurus huttoni* Smith, 1949: Hutton's pit viper
477. *Trimeresurus labialis* Fitzinger in: Steindachner, 1867: Nicobar pit viper
478. *Trimeresurus macrolepis* Beddome, 1862: Large-scaled pit viper
479. *Trimeresurus malabaricus* (Jerdon, 1853): Malabar pit viper
480. *Trimeresurus medoensis* Djao in: Djao & Jiang, 1977: Medo pit viper
481. *Trimeresurus popeorum* Smith, 1937: Popes' pit viper
482. *Trimeresurus andersoni* Theobald, 1868: Anderson's pit viper
483. *Trimeresurus stejnegeri* Schmidt, 1927: Stejneger's pit viper
Trimeresurus stejnegeri yunnanensis Schmidt, 1927: Yunnanese pit viper
484. *Trimeresurus strigatus* Gray, 1842: Horseshoe pit viper

ACKNOWLEDGEMENTS

I thank Debal Deb for instigating me to compile this checklist. For comments on draft lists and supplying critical literature, I thank Harry Andrews, Mohammed S. Khan, Fred Kruse Anita Malhotra, Van Wallach, Rom Whitaker and Wolfgang Wüster. Rom Whitaker and Gerard Martin offered invaluable help in coining English names presented here.

LITERATURE CITED

DAS, I. 1994. The reptiles of South Asia: checklist and distributional summary. *Hamadryad* 19: 15-40.

Accepted: 10 July, 1997.

Hamadryad, Vol. 22, No. 1, pp. 46 – 47, 1997

THE VALIDITY OF *PHILAUTUS SHYAMRUPUS* CHANDA AND GHOSH, 1989 (ANURA: RHACOPHORIDAE)

(with one text figure)

Philatus shyamrupus Chanda and Ghosh, 1989, was described on the basis of five types collected from Namdapha Biosphere Reserve, Arunachal Pradesh, north-eastern India. The taxon has been included in regional reviews (e.g., Chanda, 1994; Das, 1990; Dutta, 1992), as well as in Duellman's (1993) revision of Frost's (1985) "Amphibian Species of the World". Dubois (1992) failed to find differences between *P. shyamrupus* and *Ixalus argus* Annandale, 1912, known from a single specimen collected from "Upper Renging, Abor country", also in Arunachal Pradesh, at a distance of ca. 150 km north-west of the type locality of *P. shyamrupus*.

Boulenger (1920) considered both *Rana afghana* and *Ixalus argus* as junior synonyms of *Rana latopalmata*, while Bourret (1942) treated *I. argus* as a synonym of *Staurois latopalmata*. Gorham (1974) listed *I. argus* as a distinct species, without comment, as did Frost (1985). Subsequent workers (e.g., Dutta, 1992; Zhao and Adler, 1993), put *I. argus* in the synonymy of *Amolops afghanus*.

A comparison of the type series of *Philautus shyamrupus* (ZSI A 7944-7948) with *Ixalus argus* (ZSI 16950), as well as additional non-types *of Amolops afghanus*, bear out the synonymy of *I. argus* with *A. afghanus*, but reveals that *P. shyamrupus* is distinct in a number of features, including some not reported in the original description of Chanda and Ghosh (1989). We tabulate these differences here (Table 1). *P. shyamrupus* is a rhacophorid for the following features: small body size (ZSI 7948 [paratype], a male with enlarged testes and distended vocal sacs, the other types are females); Y-shaped terminal phalanx; lack of vomerine teeth; distal disk with circummarginal groove; and presence of an intercalary cartilage in the toe tips. *A. afghanus* is known to be substantially larger: a sample of 10 males measured by Yang (1991) from Thailand exhibited a SVL range of 37.0-43.0 mm.

Relegation of *P. shyamrupus* to the synonymy of *A. afghanus* by Dubois (1992), without an examination of the relevant types, is therefore in error, and we formally revive *Philautus shyamrupus* Chanda and Ghosh, 1989 as a distinct species of rhacophorid, which is known only from the type locality.

We thank J. R. Alfred, Acting Director, Zoological Survey of India, for facilities, and Sushil K. Dutta for staining the toe tips for demonstration of the intercalary cartilage in *Philautus shyamrupus*. Sushil K. Dutta, Darrell Frost and Robert F. Inger for reading the manuscript.

LITERATURE CITED

ANNANDALE, N. 1912. Zoological results of the Abor Expedition 1911-1912. I. Batrachia. *Rec. Zool. Surv. India* 8: 7-36; Pl. II-IV.

BOULENGER, G. A. 1920. A monograph of the south Asian, Papuan, Melanesian and Australian frogs of the genus *Rana*. *Rec. Indian Mus.* 20: 1-226.

TABLE 1: Morphological differences between the types of *Ixalus argus* Annandale, 1912 (ZSI 16950) and *Philautus shyamrupus* Chanda and Ghosh, 1989 (ZSI A7944-48). Abbreviations used: SVL = snout-vent length; HL = head length; HW = head width; and TBL = tibia length.

	Ixalus argus	*Philautus shyamrupus*
Head	As long as wide (HL/HW ratio 1.01)	Wider than long (HL/HW ratios 0.81-0.83)
Skin of dorsum	With small scattered tubercles	Smooth
Tibia	Relatively long (TBL/SVL ratio 0.66)	Relatively short (TBL/SVL ratios 0.47-0.57)
Body size (SVL)	24.8 mm	17.97-23.16 mm
Limb pattern	With dark cross-bars	Unicoloured, without dark cross-bars
Dark median stripe	Absent	Present
Webbing on toes II (outer) and IV (inner)	To base of terminal disk	To first subarticular tubercle (one phalange free of web)

FIGURE 1: Comparison of the holotypes of *Ixalus argus* Annandale, 1912 (ZSI 16950) and *Philautus shyamrupus* Chanda and Ghosh, 1989 (ZSI A 7944).

BOURRET, R. 1942. Les batrachiens de l'Indochine. Institut Océanographique de l'Indochine, Hanoi. x + 547 pp.

CHANDA, S. K. 1994. Anuran (Amphibian) fauna of northeast India. *Mem. Zool. Surv. India* 18(2): i-iv + 1-143 + [maps] a-w.

_____ & A. K. GHOSH. 1989. A new frog of the genus *Philautus* Gistel, from the proposed Namdapha Biosphere Reserve, Arunachal Pradesh, northeastern India. *J. Bombay nat. Hist. Soc.* 86: 215-217.

DAS, I. 1990. Amphibians from India- some further species. *J. Bombay nat. Hist. Soc.* 87: 310-312.

DUBOIS, A. 1992. Notes sur la classification des Ranidae (Amphibiens Anoures). *Bull. Mens. Soc. Linn. Lyon* 61(10): 305-352.

DUELLMAN, W. E. 1993. Amphibian species of the world: additions and corrections. *Univ. Kansas Mus. nat. Hist. Sp. Publ.* (21): i-iii + 1-372.

DUTTA, S. K. 1992. Amphibians of India: Updated species list with distribution record. *Hamadryad* 17: 1-13.

FROST, D. R. (Ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc. and Association of Systematic Collections, Lawrence. v + 732 pp.

GORHAM, S. W. 1974. Checklist of world amphibians up to January, 1970. The New Brunswick Museum, St. John. 173 pp.

YANG, D.-T. 1991. Phylogenetic systematics of the *Amolops* group of ranid frogs of southeast Asia and the Greater Sunda Islands. *Fieldiana Zool. n.s.* (63): i-iii + 1-42.

ZHAO, E.-M. & K. ADLER. 1993. Herpetology of China. Contributions to Herpetology No. 10. Society for the Study of Amphibians and Reptiles, Oxford, Ohio. 522 pp + 48 pl + 1 folding map.

Shyamal K. Chanda and Anurup K. Sarkar, Zoological Survey of India, Fire-Proof Spirit Building, 27, J. L. Nehru Road, Calcutta 700 071, India.

Accepted: 29 April, 1997.

Hamadryad, Vol. 22, No. 1, pp. 48 – 49, 1997

THE SYSTEMATIC STATUS OF *NYCTIBATRACHUS SANCTIPALUSTRIS MODESTUS* RAO, 1920 (ANURA: RANIDAE)

Nyctibatrachus sancti-palustris and *Nyctibatrachus sancti-palustris modestus* (specific names hyphenated in both instances) were described on the same page of a paper by Rao (1920: 125). Though no further citation of the second taxon has been made in regional checklists (e.g., Dutta, 1992; Frost, 1985; Gorham, 1974; Inger and Dutta, 1986), the existence of the holotype (Zoological Survey of India; ZSI 19179 and probably the paratype, Zoological Survey of Pakistan; ZSP Am-T.2; fide Siddiqi, 1973; the latter not examined by us) make the subspecific name potentially available. Dubois ("1986" 1987: 68) considered *N. s. modestus* to be specifically distinct, a move followed by Duellman (1993).

The holotype of *Nyctibatrachus sanctipalustris modestus* is a well preserved specimen measuring 23.3 mm in SVL (snout-vent length) 23.3 mm. Rao (1920) differentiated this taxon from *N. sanctipalustris* (SVL of types, 21.6 and 37.1 mm) using the following characters: 1. throat length relatively narrower; 2. snout length relatively shorter; 3. nostril nearer tip of snout (implying that nostril is closer to orbit in *sanctipalustris*); 4. interorbital width greater than twice upper eyelid width (condition in *sanctipalustris* not mentioned); 5. lack (vs presumed presence) of a canthus rostralis; 6. an elongated (vs rounded) metatarsal tubercle; 7. tarso-metatarsal articulation reaches (vs presumably fails to reach) snout or beyond; 8. skin with longitudinal dermal folds (vs presumably without folds); and 9. colouration "Pinkish above, more or less blotched" (vs "Reddish brown above"). Of these, only character states 2, 3, 5, 6 and 8 can be considered important for systematics.

We compared the holotype of *Nyctibatrachus sanctipalustris modestus* with the types of *Nyctibatrachus sanctipalustris* (ZSI 19183 and 19184), and discuss the purported differences below:

Snout length: Snout length to SVL ratios were 0.18 in *Nyctibatrachus sanctipalustris modestus*; 0.15 and 0.18 in *N. sanctipalustris*.

Position of nostril: In all material examined, the nostril was nearer to snout-tip than to orbit. The ratio of eye-nostril distance to eye-snout tip distance is 0.52 in the holotype of *Nyctibatrachus sanctipalustris modestus*, 0.43 and 0.61 in the types of *N. sanctipalustris*.

Canthus rostralis: Absent in both name bearing types.

Shape of metatarsal tubercle: Hind limbs of the syntype of ZSI 19183 are flexed, those of the other syntype, ZSI 19184 are folded. The tarso-metatarsal articulation being at the site of the metatarsal tubercle, the tubercle appears rounded (Fig. 17 in Rao's Plate) in the former (similar in shape to the holotype of *Nyctibatrachus sanctipalustris modestus*), elongated (Fig. 18) in the latter.

Skin of dorsum: Longitudinal dermal folds on the dorsum are not visible on the types of either taxa, although this may be an artifact of preservation.

In addition, although Rao (1920) claimed to have compared the new subspecies with specimens the same size (presumably of *Nyctibatrachus sanctipalustris*), his Fig. 13 appears to be that of the larger female holotype (ZSI 19184) of *N. sanctipalustris*. The ratio of throat length to head width which (Rao, 1920) used to diagnose the subspecies *modestus*, falls close to the range of the two types of *N. sanctipalustris* (0.50 vs 0.40 and 0.46).

We therefore synonymise *Nyctibatrachus sanctipalustris modestus* Rao, 1920 with *N. sanctipalustris* Rao, 1920.

We thank J. R. Alfred for permission and facilities at the ZSI and Kraig Adler and Sushil K. Dutta for comments.

LITERATURE CITED

DUBOIS, A. "1986" 1987. Miscellanea taxinomica batrachologica (I). *Alytes* 5(1-2): 7-95.

DUELLMAN, W. E. 1993. Amphibian species of the world: Additions and corrections. *Univ. Kansas Mus. nat. Hist. Spec. Publ.* (21): i-iii + 1-372.

DUTTA, S. K. 1992. Amphibians of India: Updated species list with distribution record. *Hamadryad* 17: 1-13.

FROST, D. R. (Ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc. and Association of Systematics Collections, Lawrence. v + 732 pp.

GORHAM, S. W. 1974. Checklist of world's amphibians up to January, 1970. The New Brunswick Museum, St. John. 173 pp.

INGER, R. F. & S. K. DUTTA. 1986. An overview of the amphibian fauna of India. *J. Bombay nat. Hist. Soc.* 83(suppl.): 135-146.

RAO, C. R. N. 1920. Some south Indian batrachians. *J. Bombay nat. Hist. Soc.* 27: 119-127; Pl. I - II.

SIDDIQI, M. S. U. 1973. (National Standardised Zoological Collection Number). *Rec. Zool. Surv. Pakistan* 3(1/2): i-vi + 1-101.

Shyamal K. Chanda[1] and Indraneil Das[2]; [1]Zoological Survey of India, Fire-Proof Spirit Building, 27 J. L. Nehru Road, Calcutta 700 016, India. [2]Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India

Accepted: 11 June, 1997.

Hamadryad, Vol. 22, No. 1, pp. 49 – 50, 1997

A RECORD OF *GECKOELLA NEBULOSUS* (BEDDOME, 1870) FROM ORISSA

(with one text figure)

Geckoella nebulosus (Beddome, 1870) was originally described as *Gymnodactylus nebulosus* and allocated to the genus *Geckoella* by Kluge (1993). The species is known from Golconda Hills, Gorge Hill, Godavery, Russelconda and Nelamba, in Andhra Pradesh State, southern India (Smith, 1935). Sanyal (1993) recorded the species from Madpad in Koraput District, Orissa.

An adult male (with bulging tail base, indicating the presence of hemepenes) of *G. nebulosus* taken from Barbara Reserve Forest (19° 48'N; 85° 18'E), near Banapur, Puri District, Orissa, on 9 May, 1996. The following species were also observed at the locality: *Hemidactylus brookii*, *H. flaviviridis*, *H. frenatus*, *Lygosoma punctatum*, *Mabuya macularia*, *Calotes versicolor* and *Psammophilus blanfordanus*.

The record of *Geckoella nebulosus* from Barbara Reserve Forest is the second record of the species from the State of Orissa and represents a range extension of the species by ca. 300 km to the north. The specimen (ZSI 25121; Fig. 1) shows the following features: SVL 38.4 mm; TL 30.6 mm; 40 midbody scale rows; dorsum with dark rounded paired sinous spots and enlarged tubercles; lacking preanal and femoral pores.

FIGURE 1: *Geckoella nebulosus* (Beddome, 1870) from Orissa (ZSI 25121).

LITERATURE CITED

BEDDOME, R. H. 1870. Descriptions of new reptiles from the Madras Presidency. *Madras Monthly J. Med. Sci.* 1: 169-176.

KLUGE, A. G. 1993. Gekkonid lizard taxonomy. International Gecko Society, San Diego. 245 pp.

SANYAL, D. P. 1993. Reptilia. *In*: Fauna of Orissa. State Fauna Series 1. pp: 1-55. A. K. Ghosh (Ed.) Zoological Survey of India, Calcutta.

SMITH, M. A. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II.- Sauria. Taylor and Francis, London. xiii + 440 pp + 1 pl.

Sushil K. Dutta, Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar 751 004, Orissa, India.

Accepted: 5 July, 1997.

Hamadryad, Vol. 22, No. 1, pp. 50 – 53, 1997

ON THE ETYMOLOGY OF ASIAN SNAKES OF THE GENUS *PSAMMOPHIS* (SERPENTES: COLUBRIDAE)

The Afro-Asian snake genus *Psammophis*, commonly known as sand snakes (Branch, 1988), is known from Africa and southern Asia, including India. Of the 22 known species, only five are known to occur in Asia. The group is poorly known, and this contribution is part of a larger survey on the five species.

The etymological origins of scientific names and their meanings are sometimes obscure. The importance of proper usage of nomenclatural rules is evident for international discussions of systematical problems. The names of five *Psammophis* species are discussed. Their derivatio nominis (linguistic origin of word) is given, along with vernacular names. For each species, a short description of the distribution range is included.

Abbreviation.- Gr. implies an origin from Greek; Lat. for Latin; f. and m. refer to feminine and masculine (grammatical gender), respectively.

Psammophis H. Boie in: Fitzinger, 1826

Some authors date the year of the generic description back to 1825 (e.g., Fitzsimons, 1962), while others mention 1827 as the year of the original description (Flower, 1933). Boie published his description in 1826. Some authors, particularly those dealing with the Asian species of the genus, credit the name to Fitzinger, 1826 (e.g., Anderson, 1963; Mahendra, 1984; Latifi, 1991; Leviton *et al.*, 1992). However, according to Loveridge (1957), Fitzinger himself attributed the name to Boie, and therefore, the latter is responsible for the generic name (Priority Rule).

Distribution.- Members of the genus are distributed throughout Africa and in western, southern and part of south-east Asia, covering habitats from the coast to the high mountains, from the north to the south. Species of the genus inhabit deserts, savannahs, rainforests, swamps and cultivated fields. Five species are known to occur in Asia, inhabiting dry steppe regions as well as the plains and forested habitats.

Derivatio nominis.- Gr. *psammos*, f., sand; Gr. *ophis*, m., snake

The generic name refers either to the sandy habitat of some *Psammophis* species or to the sand-coloured skin of some species (e.g., *Psammophis schokari*). Boie's intention of naming the genus sand snakes remains unclear, as the type species for his *Coluber sibilans* (presently *Psammophis sibilans*), is a brightly coloured snake that is found in cultivated fields and irrigated areas of the Nile Valley, Egypt.

Vernacular names.- The name sand snake appears appropriate, as it is a literal translation of the scientific name. Some authors (e.g., Fitzsimons, 1962) have referred to them as grass snakes, and Coborn (1991) calls them sand racers, referring to their speed., as have German authors such as Brehm (1922), who call them sandrennattern.

THE SPECIES

Psammophis condanarus (Merrem, 1820)

Two subspecies of this, the most well-known, Asian member of the genus, are recognized: *P. condanarus condanarus* (Merrem, 1820) and *P. condanarus indochinensis* M. A. Smith, 1947.

Distribution.- India, Pakistan, Nepal, Thailand, Myanmar (formerly Burma), Indo-China (Laos, Kampuchea and Vietnam), Java and Bali.

Derivatio nominis.- The specific name condanarus was made available by Merrem (1820), based on information in Russell (1796) who mentions that the rural people of the eastern coast of India call the snake is Condanarous.

The subspecific name (*indochinensis*) for the south-east Asian subspecies is clearly derived from its distribution range.

Vernacular names.- Included in this category are the names Asian sand snake (Ineich and Deuve, 1990), condanarous sand snake (Daniel, 1983) and Indo-Burmese sand snake (Gharpurey, 1962).

Psammophis leithi Günther, 1869

Distribution.- India and Pakistan.

Derivatio nominis.- The species has been named in honour of a Dr. A. Leith whose collection of snakes from Asia included the type specimen (Boulenger, 1896). The International Code of Zoological Nomenclature (ICZN Appendix D III. 16) recommends the dropping of the second i in the specific name.

Vernacular name.- The only vernacular name used is ribbon snake by Bilqees (1978).

Psammophis lineolatus (Brandt, 1838)

Distribution.- Iran, Balochistan (Pakistan), Afghanistan, Mongolia, China and the Commonwealth of Independent States.

Derivatio nominis.- Lat. *lineolatus*,-a,-um, slightly lineated, from Lat. *lineola*,-ae, f., small line

The scientific name refers to the long stripes on dorsum, usually represented by series of short dashes on scale margins.

Originally described as a member of the newly established subgenus *Taphrometopon* within the genus *Coluber*, the affinities of this species soon became obvious. Synonyms includes a large number of errors and misspellings of the specific name. While Khan's (1982) variation (*leineolatus*) is an obvious typo, as he gives the correct version of the name in the same text, other authors have obviously ignored the Code. The rules specify that the specific name should fit the generic name in grammatical gender. Coborn (1991) and David *et al.* (1994) (*lineolatum*) have obviously referred their version to the neuter name of *Taphrometopon* instead of using the masculine form fitting the generic name *Psammophis*. Sevcik's (1989) *lineolata* is wrong, as is Peters' (1991) *lineatus*.

Vernacular names.- Indigenous names used include Khorasani Teer Snake and Teer Snake (Latifi, 1991), meaning arrow snake, the last name used by Nikol'skii (1915).

Psammophis longifrons Boulenger, 1890

Distribution.- India.

Derivatio nominis.- Lat. *longus*,-a,-um, long; Lat. *frons*, f., forehead.

The name for this, the least known Asian member of the genus, is presumably in reference to the relatively slender frontals.

Psammophis schokari (Forsskål, 1775)

Distribution.- *Psammophis schokari* has the widest distributional range of all *Psammophis* species discussed herein. It is known from the North of Africa, from the western Atlantic coast (Morocco) to the Red Sea (Egypt), through Arabia and the Middle East, to as far east as northwestern India. The countries in which the species occurs are therefore: Morocco, Sénégal, Mali, Algeria, Tunisia, Niger, Libya, Chad, Egypt, Sudan, Ethiopia, Eritrea, Somalia, Yemen, UAE, Bahrain, Saudi Arabia, Jordan, Israel, Lebanon, Syria, Iraq, Kuwait, Iran, Commonwealth of Independent States, Afghanistan, Pakistan and India.

Derivatio nominis.- The name *schokari* is derived from the Arabian shigari which means from the trees, referring to the partially arboreal lifestyle of the snake (Corkill and Cochrane, 1966).

Vernacular names.- Vernacular names include sand snake (Schmidt, 1953; Hingley, 1988; Gallagher, 1971; 1990), Schokari sand-snake (Flower, 1933; Loveridge, 1940; Marx, 1968), variable sand snake (Corkill, 1935; Osman and El Sir, 1988), Afro-Asian sand snake (Marx, 1968), Forsskål's sandsnake (Gruber, 1989), Momayex snake (Latifi, 1991), Sind sand snake (Phelps, 1989), Teer snake (Latifi, 1991) and tree snake (Gallagher, 1990). Gallagher's tree snake

is the literal translation of the scientific name, but is misleading as the species is not arboreal.

We gratefully acknowledge the support of Georg C. Mosbacher, University of Saarbrücken and Wolfgang Böhme, Zoological Museum Alexander Koenig, Bonn, as well as Kraig Adler for his comments.

LITERATURE CITED

ANDERSON, S. C. 1963. Amphibians and reptiles from Iran. *Proc. Calif. Acad. Sci. (ser. 4)* 31(16): 417-498.

BILQEES, F. M. 1978. Occurrence of *Paradistomoides mujibi* Kaikabad and Bilqees (Trematoda: Dicrocoeliidae) in the ribbon snake *Psammophis leithii* in Karachi. *Sind Univ. Res. J. (Sci. Ser.)* 11: 79-82.

BOULENGER, G. A. 1896. Catalogue of the snakes in the British Musum (Natural History). Volume III., containing the Colubridae (Opisthoglyphae and Proteroglyphae), Amblycephalidae, and Viperidae). British Museum, London. xiv + 727 pp + Pl. I-XXV.

BRANCH, W. R. 1988. Field guide to the snakes and other reptiles of Southern Africa. Struik Publishers, Cape Town. 328 pp.

BREHM, A. 1992. Die Lurche und Kriechtiere II. Bibliographiches Institut, Lepizig. 212 pp.

COBORN, J. 1991. The atlas of snakes. T. F. H. Publications, Neptune, New Jersey. 591 pp.

CORKILL, M. D. 1935. Notes on Sudan snakes. *Sudan Govt. Mus. (Nat. Hist.) Publ.* 3: 1-40.

CORKILL, N. L. & J. A. COCHRANE. 1966. The snakes of the Arabian peninsula and Socotra. *J. Bombay nat. Hist. Soc.* 62(3): 475-506.

DANIEL, J. C. 1983. The book of Indian reptiles. Oxford University Press. Bombay Natural History Society, Bombay. 141 pp.

DAVID, P., G. NAULLEAU & Y. VASSE. 1994. Lebensraun und Lebensweise. *In*: Schlangen. pp: 124-138. R. Bauchot (Ed.) Naturbuch Verlag, Augsburg.

FITZINGER, L. J. F. T. 1826. Neue Classification der Reptilien nach ihren Natürlichen Verwandtschaften. Nebst einer Verwandtschafts-Tafel und einem Verzeichnisse der Reptilien-Sammlung des k. k. zoologischen Museums zu Wien. J. G. Huebner, Wien (= Vienna). viii + 66 pp; 1 folding table.

FITZSIMONS, V. F. M. 1962. Snakes of Southern Africa. Purnell & Sons Ltd., Cape Town/Johannesburg. 423 pp + 43 b x w pl. + 74 col. pl.

FLOWER, S. S. 1933. Notes on the recent reptiles and amphibians of Egypt, with a list of the species recorded from that Kingdom. *Proc. Zool. Soc. London* 1933(II): 735-851.

GALLAGHER, M. D. 1971. The amphibians and reptiles of Bahrain. Privately published, Bahrain. 39 pp.

_____. 1990. Snakes of the Arabian Gulf and Oman. Privately published, Muscat. 16 pp.

GHARPUREY, K. G. 1962. Snakes of India and Pakistan. Popular Prakashan, Bombay, 156 pp.

GRUBER, U. 1989. Die Schlangen Europas. Kosmos, Franckh'sche Verlagsbuchhandlung, Stuttgart. 248 pp.

HINGLEY, K. J. 1988. The sand snake *Psammophis schokari* in captivity. *Snake Keeper* 2(2): 16-18.

INEICH, I. & J. DEUVE. 1990. *Psammophis condanarus* (Geographic distribution). *Herpetol. Rev.* 21(1): 23.

KHAN, M. S. 1982. An annotated checklist and key to the reptiles of Pakistan. Part III: Serpentes (Ophidia). *Biologia, Lahore* 28(2): 215-254.

LATIFI, M. 1991. The snakes of Iran. Society for the Study of Amphibians and Reptiles. Contributions to Herpetology Number 7, Oxford, Ohio. viii + 159 pp + 26 pl.

LEVITON, A. E., S. C. ANDERSON, K. ADLER & S. A. MINTON. 1992. Handbook to Middle East amphibians and reptiles. Society for the Study of Amphibians and Reptiles. Contributions to Herpetology, Number 8, Oxford, Ohio. vi + 252 pp; 33 pl.

LOVERIDGE, A. 1940. Revision of African snakes of the genera *Dromophis* and *Psammophis*. *Bull. Mus. Comp. Zool.* 87(1): 1-69.

_____. 1957. Checklist of the reptiles and amphibians of East Africa (Uganda; Kenya; Tanganyika; Zanzibar). *Bull. Mus. Comp. Zool.* 117(2): 151-362.

MAHENDRA, B. C. 1984. Handbook of the snakes of India, Ceylon, Burma, Bangladesh, and Pakistan. *Ann. Zool.* 22(B): 1-412.

MARX, H. 1968. Checklist of the reptiles and amphibians of Egypt. Sp. Publ. US Naval Medical Res. Unit, Cairo. 91 pp.

MERREM, B. 1820. Tentamen Systematis Amphibiorum. Johann Christian Krieger, Marburg. xv + 191 pp.

NIKOL'SKII, A. M. 1916. Fauna of Russia and adjacent countries. Reptiles. Vol. III. Ophidia. Israel Programme for Scientific Translations, Jerusalem. Translated into English 1964. 247 pp; Pl. I-VIII.

OSMAN, H. E. S. I. & N. T. EL SIR. 1988. The snakes of the Sudan 1. The snakes of Khartoum province. *The Snake* 20: 74-79.

PETERS, G. 1991. Klasse Reptilia - Kriechtiere. *In*: Urania Tierreich. Frösche Lurche Kriechtiere. pp: 476-684. Urania, Leipzig.

RUSSELL, P. 1796. An account of Indian serpents collected on the coast of Coromandel; containing descriptions and drawings of each species; together with experiments and remarks on their several poisons. George Nicol, London. viii + 90 pp + Pl. I-XLVI.

SCHMIDT, K. P. 1953. Amphibians and reptiles of Yemen. *Fieldiana Zool.* 39(4): 21-40.

SEVCIK, J. 1989. Reptilien des südlichen Tadschikistan. *DATZ* 42: 423-425.

Frank Brandstaetter and Michela Redl, Neunkirchen Zoological Garden, D- 66538 Neunkirchen, Germany.

Accepted: 14 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 53 – 55, 1997

REDISCOVERY OF THE HOLOTYPES OF *OPHISOPS JERDONI* BLYTH, 1853 AND *BARKUDIA INSULARIS* ANNANDALE, 1917

(with two text figures)

The zoological holdings (including the types of new species described by the staff and members of the Asiatic Society of Bengal), after the passing of the Museum Act in 1866, came to the Natural History Section of the Indian Museum in 1875 (Fermor, 1936), and subsequently, to the Zoological Survey of India in 1916 (Roonwal, 1963; Sewell, 1932). Although no catalogue of the herpetological material in this institution exists, remarks on the same have been made in the works of Frost (1985) for amphibians and Smith (1931-43) for reptiles.

Several types of reptile species described by the staff of either the Asiatic Society of Bengal or the Indian Museum have been reported lost. While a few have been recently rediscovered among the general collections of the Survey (e.g., Sanyal and Talwar, 1975; Talukdar *et al.*, 1980; 1989), the types of several species which are at present considered valid are still considered lost, including two saurians, *Ophisops jerdoni* Blyth, 1853 and *Barkudia insularis* Annandale, 1917.

An examination of the holdings resulted in the discovery of the holotypes of both these species, which is being reported in this communication. The condition of the types are briefly described and both types are illustrated.

Ophisops jerdoni Blyth, 1853: Blyth (1853) described *Ophisops jerdoni* from "Mhow" (22° 33'N; 75° 46'E, in Madhya Pradesh, central India), mentioning that the material was collected by T. C. Jerdon. Smith (1935) reported that the type was lost. We consider ZSI 2196 to be the holotype, as it matches Blyth's (1853) original description of the species and bears a label with the following data: "2196 (13A) A.S.B. [= Asiatic Society of Bengal] Mhow, C.I. [= Central India], T. Jerdon". The type is an adult male with functional femoral pores and a partial tail (Fig. 1). Jerdon (1870: 71-72) himself makes a mention of the Mhow specimen, and implies that no

MAHENDRA, B. C. 1984. Handbook of the snakes of India, Ceylon, Burma, Bangladesh, and Pakistan. *Ann. Zool.* 22(B): 1-412.

MARX, H. 1968. Checklist of the reptiles and amphibians of Egypt. Sp. Publ. US Naval Medical Res. Unit, Cairo. 91 pp.

MERREM, B. 1820. Tentamen Systematis Amphibiorum. Johann Christian Krieger, Marburg. xv + 191 pp.

NIKOL'SKII, A. M. 1916. Fauna of Russia and adjacent countries. Reptiles. Vol. III. Ophidia. Israel Programme for Scientific Translations, Jerusalem. Translated into English 1964. 247 pp; Pl. I-VIII.

OSMAN, H. E. S. I. & N. T. EL SIR. 1988. The snakes of the Sudan 1. The snakes of Khartoum province. *The Snake* 20: 74-79.

PETERS, G. 1991. Klasse Reptilia - Kriechtiere. *In*: Urania Tierreich. Frösche Lurche Kriechtiere. pp: 476-684. Urania, Leipzig.

RUSSELL, P. 1796. An account of Indian serpents collected on the coast of Coromandel; containing descriptions and drawings of each species; together with experiments and remarks on their several poisons. George Nicol, London. viii + 90 pp + Pl. I-XLVI.

SCHMIDT, K. P. 1953. Amphibians and reptiles of Yemen. *Fieldiana Zool.* 39(4): 21-40.

SEVCIK, J. 1989. Reptilien des südlichen Tadschikistan. *DATZ* 42: 423-425.

Frank Brandstaetter and Michela Redl, Neunkirchen Zoological Garden, D- 66538 Neunkirchen, Germany.

Accepted: 14 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 53 – 55, 1997

REDISCOVERY OF THE HOLOTYPES OF *OPHISOPS JERDONI* BLYTH, 1853 AND *BARKUDIA INSULARIS* ANNANDALE, 1917

(with two text figures)

The zoological holdings (including the types of new species described by the staff and members of the Asiatic Society of Bengal), after the passing of the Museum Act in 1866, came to the Natural History Section of the Indian Museum in 1875 (Fermor, 1936), and subsequently, to the Zoological Survey of India in 1916 (Roonwal, 1963; Sewell, 1932). Although no catalogue of the herpetological material in this institution exists, remarks on the same have been made in the works of Frost (1985) for amphibians and Smith (1931-43) for reptiles.

Several types of reptile species described by the staff of either the Asiatic Society of Bengal or the Indian Museum have been reported lost. While a few have been recently rediscovered among the general collections of the Survey (e.g., Sanyal and Talwar, 1975; Talukdar *et al.*, 1980; 1989), the types of several species which are at present considered valid are still considered lost, including two saurians, *Ophisops jerdoni* Blyth, 1853 and *Barkudia insularis* Annandale, 1917.

An examination of the holdings resulted in the discovery of the holotypes of both these species, which is being reported in this communication. The condition of the types are briefly described and both types are illustrated.

Ophisops jerdoni Blyth, 1853: Blyth (1853) described *Ophisops jerdoni* from "Mhow" (22° 33'N; 75° 46'E, in Madhya Pradesh, central India), mentioning that the material was collected by T. C. Jerdon. Smith (1935) reported that the type was lost. We consider ZSI 2196 to be the holotype, as it matches Blyth's (1853) original description of the species and bears a label with the following data: "2196 (13A) A.S.B. [= Asiatic Society of Bengal] Mhow, C.I. [= Central India], T. Jerdon". The type is an adult male with functional femoral pores and a partial tail (Fig. 1). Jerdon (1870: 71-72) himself makes a mention of the Mhow specimen, and implies that no

FIGURE 1: Holotype of *Ophisops jerdoni* Blyth, 1853 (ZSI 2196).

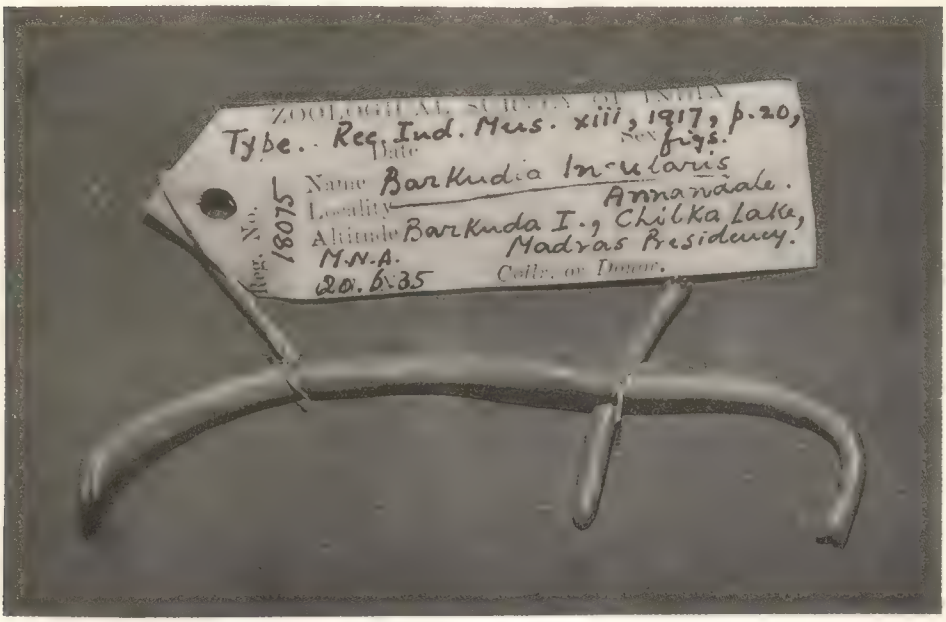

FIGURE 2: Holotype of *Barkudia insularis* Annandale, 1917 (ZSI 18075).

further material of the same has been collected from the type locality.

Barkudia insularis Annandale, 1917: Originally described by Annandale (1917), as a new genus and species from "Barkuda Island, Chilka Lake, Ganjam district, Madras Presidency" (19° 46'N; 85° 20'E, at present in Orissa State, eastern India), the holotype of *Barkudia insularis* was found extant in the ZSI. It was reported lost in the floods of Varanasi, where the collection of the Zoological Survey of India in Calcutta was stored during World War II by the Director, ZSI (according to a footnote in the paper by Ganapati and Rajyalakshmi, 1955; see also Biswas and Acharjyo, "1979" 1980). We consider ZSI 18075, an unsexed adult, to be the holotype, as it bears the original label with data on type locality and collector (F. H. Gravely) and matches the original description. It has a original, unregenerated tail that is now detached (Fig. 2).

We thank J. R. Alfred, Acting Director, ZSI, and S. K. Chanda, Superintending Zoologist, for permission and facilities to examine the material. Sujay Raha provided curatorial assistance. Kraig Adler, Darrell Frost, Allen Greer and Romulus Whitaker provided useful comments on a draft of the manuscript.

LITERATURE CITED

ANNANDALE, N. 1917. A new genus of limbless skinks from an island in the Chilka Lake. *Rec. Indian Mus.* 13(1): 17-21.

BISWAS, S. & L. N. ACHARJYO. "1979" 1980. A note on the distribution of *Barkudia insularis* Annandale, a rare limbless lizard from Orissa. *J. Bombay nat. Hist. Soc.* 76(3): 524-525.

BLYTH, E. 1853. Notices and descriptions of various reptiles, new or little known. *J. Asiatic Soc. Bengal* 22: 639-655.

FERMOR, L. L. 1936. Annual address, 1934-35. The development of scientific research in India to the end of the Nineteenth Century. *Yrbk. Asiatic Soc. Bengal* 1: 9-22.

FROST, D. R. (Ed.) 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc. and Association of Systematics Collections, Lawrence. v + 732 pp.

GANAPATI, P. N. & K. RAJYALAKSMI. 1955. Bionomics and some anatomical peculiarities of the limbless lizard *Barkudia insularis* Annandale. *Rec. Indian Mus.* 53(1 & 2): 279-291.

JERDON, T. C. 1870. Notes on Indian herpetology. *Proc. Asiatic Soc. Bengal* 1870(3): 66-85.

ROONWAL, M. L. 1963. Catalogue of type-specimens in the Zoological Survey of India. Part I.- General introduction. *Rec. Zool. Surv. India* 61(1 & 2): 89.

SANYAL, D. P. & P. K. TALWAR. 1975. *Contia mcmahoni* Wall, 1911 [Reptilia: Serpentes, Colubridae]: Rediscovery of a syntype in the Zoological Survey of India. *Newsl. Zool. Surv. India* 1(2): 14-16.

SEWELL, R. B. S. 1932. The Zoological Survey of India. *Nature, London* 129: 530-531.

SMITH, M. A. 1931. The fauna of British India, including Ceylon and Burma. Vol. I. Loricata, Testudines. Taylor and Francis, London. xxviii + 185 pp + 2 pl.

_____. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II.- Sauria. Taylor and Francis, London. xiii + 440 pp + 1 pl.

_____. 1943. The fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese region. Vol. III. Serpentes. Taylor and Francis, London. xii + 583 pp. + 1 map.

TALUKDAR, S. K., D. P. SANYAL & B. DATTAGUPTA. 1980. Rederscription (sic) of and lectotype designation for *Calamaris* (sic) *fusca* Blyth, 1854 [Serpentes: Colubridae]. *Bull. Zool. Surv. India* 3(1 & 2): 93-95.

_____, _____ & _____ . 1989. Rediscovery of holotype of *Tropidonotus striolatus* Blyth, 1868 (Serpentes: Colubridae) in the collection of the Zoological Survey of India. *J. Bombay nat. Hist. Soc.* 86(3): 462-463.

Indraneil Das[1] and Basudeb Dattagupta[2], [1]Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India. [2]Zoological Survey of India, Fire-Proof Spirit Building, 27, J. L. Nehru Road, Calcutta 700 071, India.

Accepted: 12 April, 1997.

Hamadryad, Vol. 22, No. 1, pp. 56 – 57, 1997

BREEDING DATA OF SOME AGAMID LIZARDS FROM THE WESTERN GHATS

Of the 13 species of agamid lizards reported from the Western Ghats, south-western India, seven are endemic. Information on the breeding biology of these species is scanty. This note provides some information on the breeding season, clutch and egg sizes of six species of lizards of the family Agamidae in the Western Ghats. The data was collected between January to December, 1995 while conducting surveys in the Nilgiri Biosphere Reserve, Indira Gandhi Wildlife Sanctuary, Srivilliputtur Grizzled Giant Squirrel Sanctuary and the Kalakad-Mundanthurai Tiger Reserve (see Bhupathy and Kannan, 1996).

During these surveys, live lizards were collected, palpated to determine the presence of eggs and released. Road kills and other dead specimens were dissected, and eggs measured using a vernier caliper (to the nearest 0.02 mm).

Calotes calotes (Linnaeus, 1758): On 19 July 1995, four *Calotes calotes* were observed on the ground in the Kalakad-Mundanthurai TR. They were examined by palpation. Six to eight eggs were found. *C. calotes* is highly arboreal and their presence of the ground is suspected to be for egg laying. The present record supports the observations on egg-laying season (April-September) made by other workers (e.g., Murthy, 1985; Prasad and Jayanth, 1991; Karthikeyan, 1993).

Calotes ellioti Günther, 1864: On 10 April, 1995, two dead specimens of the present species were collected from Indira Gandhi WLS. One had three, the other four oviducal eggs measuring 12.1 x 5.3 mm. They also had a second clutch of four and five developing eggs with 2 mm diameter. Clutch size in *Calotes ellioti* could be five.

Calotes rouxii Duméril & Bibron, 1837: An example of this species, killed by school children at Siruvani, NBR, was collected on 13 September, 1995. Two oviducal eggs about 2 mm diameter were observed. During the same month, a live *C. rouxi* was collected at the Indira Gandhi WLS. It had four palpable eggs. Vyas (1995) reported *Calotes rouxi* laying six eggs at Sayaji Baug Zoo in Vadodara, Gujarat. Breeding has been reported between May and September by Daniel (1983).

Psammophilus dorsalis (Gray, 1831): A specimen was collected near Srivilliputtur on 22 May, 1995. It had seven elliptical developing eggs measuring on average 7.3 x 5.2 mm. On 26 June, 1996 at the Indira Gandhi WLS, a *Psammophilus dorsalis* was found dead below a raptor nest. It contained three clutches of eggs:

i. three fully developed eggs, of average length 12.4 and width 5.6 mm;
ii. seven spherical eggs with ca. 2 mm average diameter;
iii. eight oocytes.

It was presumed that a few eggs were eaten by the predator (possibly the raptor), as the lower portion of the body was missing. Clutch size in the species could thus be seven to eight.

Salea anamallayana (Beddome, 1878): One specimen, killed by a local inhabitant, was collected from Grasshills, Indira Gandhi Wildlife Sanctuary, on 9 April, 1995. It had three clutches of eggs:

i. three fully developed elliptical eggs with an average length of 16.4 and width 7.3 mm;
ii. three undeveloped spherical eggs 3 mm in diameter;
iii. five oocytes with ca. 1 mm diameter.

The eggs of the first clutch were encased in leathery shells and appeared fully developed. The breeding season of *Salea anamallayana* has not been reported earlier.

Salea horsfieldii Gray, 1845: One live specimen of *Salea horsfieldii* was collected on 20 September, 1995 from Mukurthi National Park, NBR. Three eggs were found palpable. Smith (1935) reported that the clutch size of this species as three or four without mentioning the breeding season.

The present observations show that agamid lizards in general have an extended breeding season between January and September. The presence of more than one clutch shows that agamids are capable of laying several times during a breeding season. This strategy has obvious survival significance.

Funding for the survey was provided by the Biodiversity Hotspots Conservation Programme (BHCP) of the World Wide Fund for Nature-India. The Sálim Ali Centre for Ornithology and Natural History (SACON) offered institutional

Indian bull frog (*Hoplobatrachus tigerinus*), Patvi, Haryana, north India
© Indraneil Das. Fujichrome Sensia. This species was referred to as *Rana tigerina* in the past.

Jerdon's bull frog (*Hoplobatrachus crassus*), Vadanemmeli, Tamil Nadu, south India
© Indraneil Das. Fujichrome Velvia. This species was referred to as *Rana crassa* in the past.

Melanobatrachus indicus (ZSI A8884) in dorsal (top) and ventral (bottom) views, Vallakadavu (alt. ca. 1,000 m), Kerala State, India ©Romulus Whitaker. Fujichrome Provia. See Daltry & Martin, pp: 57-58.

facilities. We thank V. R. Chitrapu, Chief Wildlife Warden, Tamil Nadu Forest Department, for according permission to conduct the survey and S. Muralidharan, SACON, for reading a draft.

LITERATURE CITED

BHUPATHY, S. & P. KANNAN. 1996. Status of endemic lizards (Family: Agamidae) in the Western Ghats of Tamil Nadu. Final Report. Sálim Ali Centre for Ornithology and Natural History, Coimbatore.

DANIEL, J. C. 1983. The book of Indian reptiles. Bombay Natural History Society/Oxford University Press, Bombay. 141 pp.

KARTHIKEYAN, S. 1993. On the breeding of the green calotes *Calotes calotes*. *J. Bombay nat. Hist. Soc.* 90: 295.

MURTHY, T. S. N. 1985. A field guide to the lizards of Western Ghats. *Occ. Pap. Zool. Surv. India* (72): i-iii + 1-51; Pl. I-XIV.

PRASAD, J. N. & M. S. JAYANTH. 1991. Southern green calotes *Calotes calotes* at Bandipur. *J. Bombay nat. Hist. Soc.* 88: 291.

SMITH, M. A. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II.- Sauria. Taylor and Francis, London. xiii + 440 pp + 1 pl.

VYAS, R. 1995. Breeding record of *Calotes rouxi* (Duméril & Bibron). *Zoos' Print* 10(7): 36-38.

P. Kannan and S. Bhupathy, Sálim Ali Centre for Ornithology and Natural History, Kalampalayam P.O., Coimbatore 641 010, India.

Accepted: 11 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 57 – 58, 1997

REDISCOVERY OF THE BLACK NARROW-MOUTHED FROG, *MELANOBATRACHUS INDICUS* BEDDOME, 1878

(with one plate)

The amphibian genus *Melanobatrachus* (Anura: Microhylidae) is endemic to the Western Ghats of south-western India. Its only known species, *M. indicus*, was described on the basis of a small number of individuals found "curled up almost into a ball" under rotten logs at an altitude of about 1,200 m in the Anaimalai Hills (Beddome, 1878). This frog has been collected twice since, from Valparai in the Anaimalais at an altitude of 1,100 m (Roux, 1928) and from the Travancore region of Kerala by E. Girard (fide Ravichandran, 1992). The status of *M. indicus* was listed as "indeterminate" in the 1994 IUCN Red List of Threatened Animals (Groombridge, 1993).

In July 1996, more than a century after Beddome's original discovery, eight frogs were observed in Vallakadavu Reserve Forest (adjoining Periyar Tiger Reserve; altitude ca. 1,000 m), Kerala State, south-western India. All were found within a 10 m radius, resting beneath rotting logs about five metres away from a perennial stream in disturbed moist deciduous forest.

The frogs were identified as *Melanobatrachus indicus* from the following characteristics: body slender; head without cranial ridges; pupils circular; tongue oval, not forked; absence of vomerine teeth; phalanges undilated; fingers free; toes with basal webbing; skin pustular above, smooth below; colour predominantly black, with a bright scarlet patch on underside of each thigh and scarlet blotches across chest (Beddome, 1878; Boulenger, 1882; Parker, 1934; Ravichandran, 1992).

The specimen shown in Plate 2 (ZSI A8884) had the following measurements (in mm).- snout-vent length 28.7; head length (snout tip to angle of jaws) 7.1; head width (across angle of jaws) 9.0; snout length (snout tip to eye) 3.7; eye diameter 3.3; interorbital distance 2.8; tibia length 10.5. This individual was identical in size to the largest specimen previously recorded (Ravichandran, 1992).

Remarkably, only a few months after our Vallakadavu find, a further specimen was reported in the Kalakkad Tiger Reserve by Vasudevan (1996), thereby extending the known distribution range of *Melanobatrachus indicus* southwards by approximately 150 km.

Given that fewer than a dozen specimens of this striking frog have been reported this century, the status of *Melanobatrachus indicus* under IUCN criteria must still be regarded as indeterminate and potentially threatened. It is currently impossible to determine whether so few indi-

viduals have been seen because the species is genuinely rare, or because of a paucity of surveys in appropriate habitat. We therefore strongly urge that further searches be made throughout the hill ranges of south-west India, in conjunction with ecological studies to determine the conservation needs of *M. indicus* both in its terrestrial and larval stages (the latter have never been recorded). Insofar as the conservation of this frog is concerned, it is encouraging to note that both the new localities were within reserve forests.

LITERATURE CITED

BEDDOME, R. H. 1878. Description of a new batrachian from southern India, belonging to the family Phryniscidae. *Proc. Zool. Soc. London* 1878: 722.

BOULENGER, G. A. 1890. The fauna of British India. Reptilia and Amphibia. Taylor and Francis, London xviii + 541 pp.

GROOMBRIDGE, B. 1993. 1994 IUCN Red List of Threatened Animals. IUCN, Gland and Cambridge. liv + 286 pp.

PARKER, H. W. 1934. A monograph of the frogs of the family Microhylidae. British Museum (Natural History), London. vi + 208 pp.

RAVICHANDRAN, M. S. 1992. Studies on the Amphibia of southern Western Ghats. Unpublished Ph. D. Dissertation, University of Madras. 238 pg + 40 pl.

ROUX, J. 1928. Reptiles et amphibiens de l'Inde meridionale. *Rev. Suisse Zool.* 35: 439-471.

VASUDEVAN, K. 1996. Effect of rainforest fragmentation on Western Ghats amphibians. *Frogleg* (2): 1.

Jennifer C. Daltry and Gerard N. Martin, Centre for Herpetology, Madras Crocodile Bank, Post Bag 4, Mamallapuram,Tamil Nadu 603 104, India.

Accepted: 30 April, 1997.

Hamadryad, Vol. 22, No. 1, pp. 58 – 61, 1997

A CASE OF PREDATION BY *PYTHON MOLURUS* ON A FRUIT BAT, *PTEROPUS GIGANTEUS*, WITH NOTES ON BAT-SNAKE INTERACTIONS

It is commonly believed that the only predator of the Indian flying fox, *Pteropus giganteus* is man (e.g., Prater, 1971). We describe here the first observed case of *P. giganteus* predation by the Indian rock python, *Python molurus*, and comment on the incidence and significance of bat predation by snakes in general.

The incident was recorded in the Grizzled Giant Squirrel Sanctuary (formerly the Alagarkoil Reserve Forest), about 25 km north of Madurai in Tamil Nadu State, southern India. Details of the site, its fruit bat colony and a short account of the bat predation episode are given by Marimuthu and Chandrashekaran (1991). As this account was written mainly from a bat perspective and is not likely to reach the vast majority of herpetologists, we thought it beneficial to recapitulate our observations in the context of snake-bat interactions. The sighting was made during a visit to the bat colony by PP and JF, guided by G. Marimuthu (an acknowledged authority on Indian bats based at Madurai Kamaraj University, south India) on 20 November, 1991. The habitat in this area consists of mature, high forest interspersed with scrub jungle, situated in hills rising above the plains. The bats use the taller trees as daytime roosts, and are readily visible as they hang on to the higher branches, occasionally flying around the trees for short periods.

We observed the colony from around 1700 h, as the bats were preparing to depart for the nightly foraging excursion. Shortly before 1800 h, we noticed that what at first appeared to be a large branch slowly moving in the wind was in fact a python, and that it had partially ingested an adult flying fox. The snake was approximately 1.5 m long and was about 15 m up in the crown of the tree, which was in full leaf. The bat was being ingested head first, and the wings were clearly flapping in distress as it passed into the snake's mouth. The snake was positioned with its head and neck pointing downwards in mid air, with the rear three-quarters of the body tightly

TABLE 1: Recorded incidences of (or tendencies for) bat predation by snakes.

Snake species	Bat species	Where captured	Reference
Boa constrictor, Pseustes poecilonotus	*Myotis nigricans*	Roost in building	Wilson (1971)
Boa constrictor orophias	*Brachyphylla cavernarum*	Tree	Arendt & Anthony (1986)
Boa constrictor imperator	*Artibeus jamaicensis*	Roost in cave	Thomas (1974)
Boa constrictor imperator	*Desmodus rotundus*	Roost in cave	Villa and Lopez (1966)
Epicrates angulifer	*Phyllonycteris poevy*	Roost in cave	Allen (1939), Hardy (1957)
Epicrates cenchris cenchris	*Carollia perspicillata*	Roost in cave	Lemke (1978)
Epicrates inornatus	*Brachyphylla cavernarum, Monophyllus redmani*	Roost in cave	Rodriguez and Reagan (1984)
Liaisis childreni childreni, Morelia spilotes variegata	*Miniopterus australis*	Roost in cave	Morrison (1988)
Python sp	*Epomophorus* sp	Tree roost (?)	Steyn (1964)
Boiga dendrophila	*Eonycteris spelea*	Tree	Harrison (1962)
Boiga forsteni	(not stated)	Tree (?)	Daniel (1983), Smith (1943)
Elaphe guttata emoryi	(not stated)	Roost in building	Behler and King (1979)
Elaphe obsoleta	*Eptesicus fuscus*	Roost in building	Allen (1939)
Elaphe taeniura	(not stated)	Roost in cave	Smith (1943)
Elaphe sp	*Myotis velifer*	Roost in cave	Allen (1939)
Pituophis melanoleucus	*Natalus stramineus*	Roost in disused mine	Hill & Smith (1984)
Trimorphodon biscutatus	(not stated)	Roost in cave	Shaw and Campbell (1974)
Dendroaspis polylepis	*Lavia frons*	Tree/bush (?)	Allen (1939)

coiled around the tree, as it struggled with its writhing prey. After the snake had finished ingesting the bat it rested in the same position for a few minutes and then descended down the trunk. Due to the density of vegetation and the dwindling light levels, we lost sight of the snake as it descended.

Pteropus giganteus roosts can attain large proportions; this particular example was around 3000 individuals (Marimuthu and Chandrashekaran, 1991). Being effectively static for long periods during the day and predictably located in certain areas, these colonies could constitute ideal food patches for snakes. However, the problem for snakes may be approaching the colony (and, subsequently, individual bats) without being detected. The large numbers of bats at each colony may confer superior predator detection capabilities, and once discovered a potential non-avian aggressor is avoided by taking flight. Indeed, in the case described above, it was noticeable that bats had vacated the tree in which the predation occurred, although we cannot state exactly when they did this in relation to the actual capture because the strike was not observed. A snake the size of an adult *P. molurus* moving amongst the branches of a tree may appear conspicuous; however, this may be mitigated by the low light levels, somewhat cryptic colouration and slow movement of the python.

It is obviously impossible to conclude from this one incident how important bats are in the python's diet. Certainly they have not been cited as a prey item for this species. *Python molurus* is known to take a wide range of (mainly mammalian and avian) prey items (Bhupathy and Vijayan, 1989). It is an adept climber, although by no means restricted to an arboreal habit. As flying fox colonies are patchily distributed, it is unlikely that they play a major role in the dietary habits of *P. molurus* right across its range, but in certain areas where the two are sympatric this possibility exists. Bhupathy and Vijayan (1989) noted that around half of the holes used by pythons in Keoladeo National Park, Rajasthan, northern India, also served as roosts for the bicoloured leaf-nosed bat, *Hipposideros fulvus*, but no interactions between snakes and bats were reported. Further research, particularly with regard to faecal analysis and field observations, would

be required to investigate how important bats are in the diet of the Indian python.

Our observation appears to be one of the relatively few documented examples of predation by a snake on a bat in a tree roost or resting site (see Table 1). Other such cases include the St. Lucia boa, *Boa constrictor orophias* feeding on the bat *Brachyphylla cavernarum* (Arendt and Anthony, 1986). Harrison (1962) gives an account of *Boiga dendrophila* feeding on a *Eonycteris spelea* in the high branches of a fruit tree. There are various examples of snake stomach contents revealing bat prey; some seem to indicate, from the known behaviour of either species, that the predation occurred in a tree. Allen (1939) mentions a report of the stomach contents of a black mamba, *Dendroaspis polylepis* including the tree- or bush-roosting *Lavia frons*. An African Python is on record as having eaten an epauletted bat, *Epomophorus* (Steyn, 1964) in an area where the latter commonly roost in jacaranda trees. Daniel (1983) and Smith (1943) report that Forsten's cat snake *Boiga forsteni* takes bats, although it is not specified whether this refers to tree-roosting species.

There are numerous reports of snakes taking bats from caves or roosts in buildings. Whilst not exhaustive, the list in Table 1 demonstrates the taxonomic range of snakes and bats involved in predation interactions. The method of capture employed in most of these instances appears to be essentially the same. Snakes lie at the exit to the roost (often a narrow cave opening), and ambush the bats as they emerge to forage at dusk. Some authors note that snake activity coincides with bat emergence (e.g., Rodriguez and Reagan, 1984). At cave roosts used by hundreds or thousands of bats (a common situation for some species), well positioned snakes can be guaranteed access to a stream of prey items. There are also reports of snakes actively foraging for bats by searching roosts during the day when they are likely to be less active (e.g., Thomas, 1974).

Most of the snakes reported to prey on bats are boids and colubrids, and many are known to be at least semi-aboreal or adept climbers. It is probably relatively uncommon for snakes to prey on bats which are resting in large numbers in exposed tree roosts, as undetected approach would be unlikely. The flying foxes observed at the site described in this study apparently made little or no attempt to conceal themselves amongst the denser vegetation. Of course, the practical difficulties involved in observing bats and snakes in trees may contribute to the scarcity of such reports. A more common situation is for snakes to use a "sit and wait" strategy at the openings to roosts in caves, buildings, or occasionally tree trunk cavities. Where bats are predictably located in these roosts, some snake species may capitalise on their availability and here bats probably constitute a considerable proportion of their diet (e.g., *Elaphe taeniura*). It has been shown that at some sites where avian predation on bats is particularly intense, bats alter their behaviour (e.g., by shifting emergence times) to reduce the chance of attack (Fenton *et al.*, 1994). It is not known whether snake predation is sufficient to elicit such a response in bat colonies; this would seem unlikely except in cases where snakes habitually include bats in their diet.

In conclusion, the flying fox may be a relatively infrequent prey item for *Python molurus*. Indeed, from the literature, it appears that attacks by snakes on tree-roosting bats are comparatively uncommon. Further field studies, including additional observations at sites where such incidents have been recorded, will help to verify this. Bats which roost in caves or buildings, however, appear to be more prone to predation, and for some species of snake this fact seems to have important consequences on foraging behaviour.

We would like to thank G. Marimuthu for kindly showing us around Alagarkoil and Romulus Whitaker for transport.

LITERATURE CITED

ALLEN, G.M. 1939. Bats. Dover Publications, New York.

ARENDT, W. J. & D. Anthony. 1986. Bat predation by the St. Lucia boa (*Boa constrictor orophias*). *Caribbean J. Sci.* 22: 219-220.

BEHLER, J. L. & F. W. KING. 1979. Audubon Society field guide to North American reptiles and amphibians. Knopf, New York. 720 pp.

BHUPATHY, S. & V. S. VIJAYAN. 1989. Status, distribution and general ecology of the

Indian python *Python molurus molurus* Linn. in Keoladeo National Park, Bharatpur, Rajasthan. *J. Bombay Nat. Hist. Soc.* 86: 381-7.

DANIEL, J. C. 1983. The book of Indian reptiles. Oxford University Press/Bombay Natural History Society, Bombay. 141 pp.

FENTON, M. B., I. L. RAUTENBACH, S. E. SMITH, C. M. SWANEPOEL, J. GROSELL & J. VAN JAARSVELD. 1994. Raptors and bats: threats and opportunities. *Animal Behav.* 48: 9-18.

HARDY, J. D. 1957. Bat predation by the Cuban tree boa, *Epicrates angulifer* Bibron. *Copeia* 1957: 151-152.

HARRISON, T. 1962. Catsnake kills fruit bat. *Malay Nat. J.* 16: 153-4.

HILL, J. E. & J. D. SMITH. 1984. Bats: a natural history. British Museum (Natural History), London.

LEMKE, T. O. 1978. Predation upon bats by *Epicrates cenchris cenchris* in Colombia. *Herpetol. Rev.* 9: 47.

MARIMUTHU, G. & M. K. CHANDRASHEKARAN. 1991. A rare sighting of a python ingesting a flying fox from a natural colony. *Bat Research News* 31(4): 49-50.

MORRISON, R. 1988. The terrifying hazards of being a little bent-winged bat in Australia. *Geo* 10(1).

PRATER, S. 1971. The book of Indian Animals. Bombay Natural History Society, Bombay. Third Edition. xxiii + 324 pp; 69 pl.

RODRIGUEZ, G. A. & D. P. REAGAN. 1984. Bat predation by the Puerto Rican boa, *Epicrates inornatus. Copeia* 1984: 219-220.

SHAW, C. E. & S. CAMPBELL. 1974. Snakes of the American West. Knopf, New York. xii + 332 pp.

SMITH, M. A. 1943. Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese region. Vol. III. Serpentes. Taylor and Francis, London. xii + 583 pp + 1 map.

STEYN, P. 1964. Python eats fruit bat. *African Wildlife* 18: 258.

THOMAS, M. E. 1974. Bats as a food source for Boa constrictor. *J. Herpetol.* 8: 188.

VILLA, B. & W. F. LOPEZ. 1966. Cinco casos de predacion de pequenos vertebrados en murcielagos de Mexico. *An. Instit. Biol. Univ. Natl. Mexico.* 37: 187-193.

WILSON, D. E. 1971. Ecology of *Myotis nigricans* (Mammalia: Chiroptera) on Barro Colorado Island, Panama Canal Zone. *J. Zool., London* 163: 1-13.

Jim Foster[1] and Purnima Price[2], Madras Crocodile Bank, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India. Present addresses: [1]Froglife, Triton House, Bramfield, Halesworth, Suffolk IP19 9AE, UK; [2]3968 Tudor Avenue, Victoria, British Columbia V8N 4L6, Canada.

Accepted: 7 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 61 – 62, 1997

NOTES ON THE DISTRIBUTION AND DIET OF *KACHUGA SYLHETENSIS*

Kachuga sylhetensis is one of the rarest freshwater turtles in southern Asia, and is endemic to north-eastern India and Bangladesh (Das, 1995; Iverson, 1992; Moll, 1987). Available data comprise sporadic records of occurrence, and little is known of the biology of this illusive species. A survey was conducted between March 1995 to August 1996 in Kamrup District, Assam State, north-eastern India to ascertain the distribution and biology of the species. All major rivers and beels (ox-bow lakes) were visited and three live turtles collected. These were transferred to the laboratory, where they were maintained in an enclosure measuring 3.05 x 3.05 x 1.52 m.

During this study, *Kachuga sylhetensis* was collected only from Kukurmara River (91° 25'E; 26° 03'N) and Chandubi Beel (91° 26'E; 25° 56'N), located in the south-western part of Kamrup District. Kukurmara is a fast-flowing stream with sandy bottom and an extensive growth of *Ipomoea*. The habitat in Chandubi is reed beds of grasses on mud, with aquatic macrophytic vegetation, including *Nymphaea*, *Lemna*, *Pistia*, *Salvinia* and *Utricularia*. Both areas lie in the floodplains near foothills. Choudhury (1993) recorded the species from reed beds of *Arundo donax* with sluggish *nullahs* (channels) on the floodplains, and Das (1995) reported varied habitat types that range from fast flowing streams in the hills to ox-bow lakes in the plains. Based on

Indian python *Python molurus molurus* Linn. in Keoladeo National Park, Bharatpur, Rajasthan. *J. Bombay Nat. Hist. Soc.* 86: 381-7.

DANIEL, J. C. 1983. The book of Indian reptiles. Oxford University Press/Bombay Natural History Society, Bombay. 141 pp.

FENTON, M. B., I. L. RAUTENBACH, S. E. SMITH, C. M. SWANEPOEL, J. GROSELL & J. VAN JAARSVELD. 1994. Raptors and bats: threats and opportunities. *Animal Behav.* 48: 9-18.

HARDY, J. D. 1957. Bat predation by the Cuban tree boa, *Epicrates angulifer* Bibron. *Copeia* 1957: 151-152.

HARRISON, T. 1962. Catsnake kills fruit bat. *Malay Nat. J.* 16: 153-4.

HILL, J. E. & J. D. SMITH. 1984. Bats: a natural history. British Museum (Natural History), London.

LEMKE, T. O. 1978. Predation upon bats by *Epicrates cenchris cenchris* in Colombia. *Herpetol. Rev.* 9: 47.

MARIMUTHU, G. & M. K. CHANDRASHEKARAN. 1991. A rare sighting of a python ingesting a flying fox from a natural colony. *Bat Research News* 31(4): 49-50.

MORRISON, R. 1988. The terrifying hazards of being a little bent-winged bat in Australia. *Geo* 10(1).

PRATER, S. 1971. The book of Indian Animals. Bombay Natural History Society, Bombay. Third Edition. xxiii + 324 pp; 69 pl.

RODRIGUEZ, G. A. & D. P. REAGAN. 1984. Bat predation by the Puerto Rican boa, *Epicrates inornatus. Copeia* 1984: 219-220.

SHAW, C. E. & S. CAMPBELL. 1974. Snakes of the American West. Knopf, New York. xii + 332 pp.

SMITH, M. A. 1943. Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese region. Vol. III. Serpentes. Taylor and Francis, London. xii + 583 pp + 1 map.

STEYN, P. 1964. Python eats fruit bat. *African Wildlife* 18: 258.

THOMAS, M. E. 1974. Bats as a food source for Boa constrictor. *J. Herpetol.* 8: 188.

VILLA, B. & W. F. LOPEZ. 1966. Cinco casos de predacion de pequenos vertebrados en murcielagos de Mexico. *An. Instit. Biol. Univ. Natl. Mexico.* 37: 187-193.

WILSON, D. E. 1971. Ecology of *Myotis nigricans* (Mammalia: Chiroptera) on Barro Colorado Island, Panama Canal Zone. *J. Zool., London* 163: 1-13.

Jim Foster[1] and Purnima Price[2], Madras Crocodile Bank, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India. Present addresses: [1]Froglife, Triton House, Bramfield, Halesworth, Suffolk IP19 9AE, UK; [2]3968 Tudor Avenue, Victoria, British Columbia V8N 4L6, Canada.

Accepted: 7 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 61 – 62, 1997

NOTES ON THE DISTRIBUTION AND DIET OF *KACHUGA SYLHETENSIS*

Kachuga sylhetensis is one of the rarest freshwater turtles in southern Asia, and is endemic to north-eastern India and Bangladesh (Das, 1995; Iverson, 1992; Moll, 1987). Available data comprise sporadic records of occurrence, and little is known of the biology of this illusive species. A survey was conducted between March 1995 to August 1996 in Kamrup District, Assam State, north-eastern India to ascertain the distribution and biology of the species. All major rivers and beels (ox-bow lakes) were visited and three live turtles collected. These were transferred to the laboratory, where they were maintained in an enclosure measuring 3.05 x 3.05 x 1.52 m.

During this study, *Kachuga sylhetensis* was collected only from Kukurmara River (91° 25'E; 26° 03'N) and Chandubi Beel (91° 26'E; 25° 56'N), located in the south-western part of Kamrup District. Kukurmara is a fast-flowing stream with sandy bottom and an extensive growth of *Ipomoea*. The habitat in Chandubi is reed beds of grasses on mud, with aquatic macrophytic vegetation, including *Nymphaea*, *Lemna*, *Pistia*, *Salvinia* and *Utricularia*. Both areas lie in the floodplains near foothills. Choudhury (1993) recorded the species from reed beds of *Arundo donax* with sluggish *nullahs* (channels) on the floodplains, and Das (1995) reported varied habitat types that range from fast flowing streams in the hills to ox-bow lakes in the plains. Based on

our observations and the collection of specimens during the wet season (but not during the dry season) from the plains, we suggest that this species is restricted to hill streams, except during periods of heavy precipitation, when individuals may be washed downstream to the plains. Besides the records of the species in the literature, *K. sylhetensis* is here confirmed as occurring in the floodplains of western Assam, between latitudes 91-96° E.

In captivity, *Kachuga sylhetensis* is omnivorous and largely nocturnal, although some feeding does take place during early mornings. Food accepted in captivity include: fronds of *Pistia*, soft roots of *Eichhornia*, stem of *Utricularia*, leaves of *Salvinia*, fleshy parts of *Trapa*, the inner soft part of *Ipomoea batatus*, besides earthworms, molluscs, aquatic insects and prawns. Sarma (1988) observed that the species in captivity accepted small freshwater fishes, but not plants, which differs from our observations, where both live and dead fishes were refused. Earthworms appear to be a favoured item in its diet in captivity, and three to four were consumed at a time. The forelimb was utilized in prey manipulation, including keeping the prey away from the body.

LITERATURE CITED

CHOUDHURY, A. 1993. New locality records for *Kachuga sylhetensis* (Jerdon, 1870). *Hamadryad* 18: 43-45.

DAS, I. 1990. Distributional records for chelonians from north-eastern India. *J. Bombay nat. Hist. Soc.* 87: 91-97.

_____ . 1995. Turtles and tortoises of India. Oxford University Press/World Wide Fund for Nature- India, Bombay. xi + 179 pp. + 16 pl.

IVERSON, J. B. 1992. A revised checklist with distribution maps of the turtles of the world. Privately published, Richmond, Indiana. xiii + 363 pp.

JERDON, T. C. 1870. Notes on Indian herpetology. *Proc. Asiatic Soc. Bengal* 1870(3): 66-85.

MOLL, E. O. 1987. Survey of the freshwater turtles of India. Part II. The genus *Kachuga. J. Bombay nat. Hist. Soc.* 84: 7-25.

SARMA, S. 1988. A new record of the Assam roofed turtle, *Kachuga sylhetensis* (Jerdon) from the Manas Wildlife Sanctuary, Assam. *J. Bombay nat. Hist. Soc.* 85: 623-624.

SMITH, M. A. 1931. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. 1. Loricata, Testudines. Taylor and Francis, London. xxviii + 185 pp + Pl. I-II.

N. K. Choudhury[1], D. K. Sharma[2] and S. Sengupta, Department of Zoology, Arya Vidyapeeth College, Guwahati 781 016, Assam, India. [1]Present address: Department of Zoology, D. K. College, Mirza, Assam, India. [2]Present address: Department of Zoology, Guwahati University, Guwahati 781 014, Assam, India.

Accepted:10 March, 1997.

Hamadryad, Vol. 22, No. 1, pp. 62 – 63, 1997

AN ALBINO FORM OF THE INDIAN FLAPSHELL TURTLE (*LISSEMYS PUNCTATA*)

(with one text figure)

In November 1995, a yellow coloured *Lissemys punctata punctata* was donated to the Kamla Nehru Zoological Garden, Ahmedabad, Gujarat, western India. It was reportedly caught from the Hathmati River, a tributary of the Sabarmati, near Himmatnagar, Sabarkantha District, Gujarat State.

The details of size and colouration are as follows: straight carapace length 15.5 cm; straight carapace width 15.0 cm; plastron length 14.0 cm; shell height 5.0 cm; body weight 350 gm. The carapace, limbs and head were an unpatterned yellow; the plastron was light yellow with pink callosities. The eyes were pink.

Anomalous colour and patterns are rarely expressed in living animals, its cause being metabolic disorder due to inherited congenital conditions. Presence of a high degree of all integumentary pigment known as melanin or totally opposite condition, lack of all integumentary pigment, including in the eyes, is referred to as albinism. Albinism is classified on the basis of area involved, degree of involved genetic defect (Bechtel, 1995) and on the basis of absence or diminished melanin formation in

our observations and the collection of specimens during the wet season (but not during the dry season) from the plains, we suggest that this species is restricted to hill streams, except during periods of heavy precipitation, when individuals may be washed downstream to the plains. Besides the records of the species in the literature, *K. sylhetensis* is here confirmed as occurring in the floodplains of western Assam, between latitudes 91-96° E.

In captivity, *Kachuga sylhetensis* is omnivorous and largely nocturnal, although some feeding does take place during early mornings. Food accepted in captivity include: fronds of *Pistia*, soft roots of *Eichhornia*, stem of *Utricularia*, leaves of *Salvinia*, fleshy parts of *Trapa*, the inner soft part of *Ipomoea batatus*, besides earthworms, molluscs, aquatic insects and prawns. Sarma (1988) observed that the species in captivity accepted small freshwater fishes, but not plants, which differs from our observations, where both live and dead fishes were refused. Earthworms appear to be a favoured item in its diet in captivity, and three to four were consumed at a time. The forelimb was utilized in prey manipulation, including keeping the prey away from the body.

LITERATURE CITED

CHOUDHURY, A. 1993. New locality records for *Kachuga sylhetensis* (Jerdon, 1870). *Hamadryad* 18: 43-45.

DAS, I. 1990. Distributional records for chelonians from north-eastern India. *J. Bombay nat. Hist. Soc.* 87: 91-97.

_____ . 1995. Turtles and tortoises of India. Oxford University Press/World Wide Fund for Nature- India, Bombay. xi + 179 pp. + 16 pl.

IVERSON, J. B. 1992. A revised checklist with distribution maps of the turtles of the world. Privately published, Richmond, Indiana. xiii + 363 pp.

JERDON, T. C. 1870. Notes on Indian herpetology. *Proc. Asiatic Soc. Bengal* 1870(3): 66-85.

MOLL, E. O. 1987. Survey of the freshwater turtles of India. Part II. The genus *Kachuga. J. Bombay nat. Hist. Soc.* 84: 7-25.

SARMA, S. 1988. A new record of the Assam roofed turtle, *Kachuga sylhetensis* (Jerdon) from the Manas Wildlife Sanctuary, Assam. *J. Bombay nat. Hist. Soc.* 85: 623-624.

SMITH, M. A. 1931. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. 1. Loricata, Testudines. Taylor and Francis, London. xxviii + 185 pp + Pl. I-II.

N. K. Choudhury[1], D. K. Sharma[2] and S. Sengupta, Department of Zoology, Arya Vidyapeeth College, Guwahati 781 016, Assam, India. [1]Present address: Department of Zoology, D. K. College, Mirza, Assam, India. [2]Present address: Department of Zoology, Guwahati University, Guwahati 781 014, Assam, India.

Accepted:10 March, 1997.

Hamadryad, Vol. 22, No. 1, pp. 62 – 63, 1997

AN ALBINO FORM OF THE INDIAN FLAPSHELL TURTLE (*LISSEMYS PUNCTATA*)

(with one text figure)

In November 1995, a yellow coloured *Lissemys punctata punctata* was donated to the Kamla Nehru Zoological Garden, Ahmedabad, Gujarat, western India. It was reportedly caught from the Hathmati River, a tributary of the Sabarmati, near Himmatnagar, Sabarkantha District, Gujarat State.

The details of size and colouration are as follows: straight carapace length 15.5 cm; straight carapace width 15.0 cm; plastron length 14.0 cm; shell height 5.0 cm; body weight 350 gm. The carapace, limbs and head were an unpatterned yellow; the plastron was light yellow with pink callosities. The eyes were pink.

Anomalous colour and patterns are rarely expressed in living animals, its cause being metabolic disorder due to inherited congenital conditions. Presence of a high degree of all integumentary pigment known as melanin or totally opposite condition, lack of all integumentary pigment, including in the eyes, is referred to as albinism. Albinism is classified on the basis of area involved, degree of involved genetic defect (Bechtel, 1995) and on the basis of absence or diminished melanin formation in

FIGURE 1: Albinistic *Lissemys punctata* from the Hathmati River, Gujarat, western India.

animal bodies (Dyrkacz, 1981). There is also a fundamental difference between albino homoeothermic and poikilothermic animals: only one type of pigment cell melanophore is responsible for colour and pattern in the former, but in the latter, several types of pigment cells, melanophores, xanthophores and iridophores are present in pigmentary systems. Since the albino mutation is specifically melanosynthesis, the xanthophores and iridophores are unaffected. They function normally and appear well. According to Dyrkacz (1981), criteria of albinism, the yellow coloured *Lissemys punctata* described above is a partial albino with xanthophores, although H. B. Bechtel (in litt., 27 March, 1997) considers it (on the basis of examination of a colour photograph) an albino.

Albinism is reported in only a few species of reptiles that occur in India, including *Python molurus* by Lahiri (1955), *Eryx conicus* by Whitaker (1971), *Elaphe helena* by Vyas (1987) and *Naja naja* by Anon (1989; Kumar, 1988). The phenomenon is known for numerous other species of reptiles outside (North American examples reviewed by Dyrkacz, 1981).

I thank Babubhai Sheik, Kamla Nehru Zoological Gardens, for information and allowing me to examine the turtle, John Iverson for reading an earlier draft of the manuscript and H. Bernard Bechtel for his opinion on the specimen.

LITERATURE CITED

ANON. 1989. The Singapore Zoological Gardens- A tropical garden for animals. Singapore Garden, Singapore. 72 pp.

BECHTEL, H. B. 1995. Reptile and amphibian variants: color, patterns and scales. Krieger Publishing Company, Malabar, Florida. xvii + 206 pp.

DYRKACZ, S. 1981. Recent instances of albinism in North American amphibians and reptiles. *Soc. Stud. Amphib. Rept. Herpetol. Circ.* (11): 1-31.

KUMAR, P. 1988. The albino cobra. *Environ. Today* 3(1 & 2): 6-8.

LAHIRI, P. K. 1955. A white python. *J. Bombay nat. Hist. Soc.* 53: 135-136.

VYAS, R. 1987. A list of the snakes of Bhavnagar District, Gujarat State. *J. Bombay nat. Hist. Soc.* 84: 227-230.

WHITAKER, R. 1971. Notes on Indian snakes- 1. *J. Bombay nat. Hist. Soc.* 68: 461-463.

Raju Vyas, Sayaji Baug Zoo, Vadodara 390 018, Gujarat, India.

Accepted: 30 May, 1997.

Hamadryad, Vol. 22, No. 1, pp. 64, 1997

DATES OF PUBLICATION OF *HAMADRYAD* (VOLS. 1-21)

As the official organ of the Madras Snake Park Trust, the first issue of its Newsletter appeared in May, 1976. Two further issues (Vol. 1; No. 2 and Vol. 2; No. 1) appeared in the same name. From Vol. 2; No. 2 (issued September, 1977), the newsletter, which comprised mimeographed pages stapled together, was renamed *Hamadryad*. Although editorship was not acknowledged, these were compiled by Zai Whitaker. With the formal separation of the Madras Snake Park from the Madras Crocodile Bank Trust, the latter organization took charge of producing this newsletter, from Vol. 10; No. 1 (issued in May, 1985). From Vol. 15 (issued in 1991, although dated 1990), the periodical was upgraded to the status of a peer-reviewed journal. Zai Whitaker continued to edit the journal, up to Vol. 16. Since Vol. 15, a single issue has been produced in a calender year, although increasing manuscript submissions, in addition to the financial solvency of the journal, will permit two issues a year from Vol. 22. Here at *Hamadryad*, we work as a team, with support from virtually every staff member of the Madras Crocodile Bank. Associate Editors, Harry Andrews and Romulus Whitaker help vet papers and find suitable reviewers. Editorial Coordinator Romaine Andrews assists in sending manuscripts for review and answers queries from authors, besides keyboarding manuscripts. Our DTP consultant Luc Gastmans comes all the way from Pondicherry and this is his seventh issue of the journal. The professional look of the recent issues of *Hamadryad* is entirely his work. Editorial Board Members help both with reviews and editorial policies, and we are particularly grateful to our reviewers for the time they spend on the papers we send them for review.

Since the date of publication is of great importance to both students of taxonomy and nomenclature, provided herein are the year (and when possible, the month) of publication of each issue of *Hamadryad*. Also annotated are herpetological taxa made available in each fascicle.

Vol	No	Date of Issue	New Species
1	1	May 1976	-
1	2	December 1976	-
2	1	May 1977	-
2	2	September 1977	-
3	1	January 1978	-
3	2	May 1978	-
4	1	January 1979	-
4	2	May 1979	-
4	3	September 1979	-
5	1	January 1989	-
5	2	(not issued)	-
5	3	September 1980	-
6	1	January 1981	-
6	2	May 1981	-
6	3	September 1981	-
7	1	January 1982	-
7	2	May 1982	-
7	3	September 1982	-
8	1	January 1983	-
8	2	May 1983	-
8	3	September 1983	-
9	1	January 1984	-
9	2	May 1984	-
9	3	September 1984	-
10	1 & 2	May 1985	-
10	3	September 1985	-
11	1 & 2	April 1986	-
11	3	September 1986	-
12	1	May 1987	-
12	2	September 1987	-
13	1	May 1988	-
13	2	December 1988	-
14	1	July 1989	-
15	1 & 2	1991 (for 1990)	*Rana ghoshi* Chanda
16	1 & 2	1992 (for 1991)	-
17	-	July 1994 (for 1992)	-
18	-	October 1994 (for 1993)	*Cnemaspis gordongekkoi* Das
19	-	December 1994	-
20	-	December 1995	*Polypedates insularis* Das
21	-	January 1997 (for 1996)	-

Indraneil Das, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

Accepted: 31 May, 1997.

REPTILE AND AMPHIBIAN VARIANTS: COLORS, PATTERNS AND SCALES by H. Bernard Bechtel. 1995. Krieger Publishing Co., Florida. xvii + 206 pp. ISBN 0-89464-862-4. Available from: Krieger Publishing Company, 1725 Krieger Drive, Malabar, Florida 32950, USA. Price: US$ 70.95.

In January of this year, a young adult female *Eryx conicus* was dug up not far from the Centre for Herpetology at Therkupattu. Nothing very remarkable in that, you might think, for sand boas are common throughout much of Tamil Nadu State. But this was no ordinary *E. conicus*. Instead of being the conventional rich brown colour with darker brown or black blotches, this one was white as snow apart from its coal-black eyes and some blurred fawn markings along the back. How could this oddity be explained?

The obvious place to seek further information was "Reptile and Amphibian Variants: Colors, Patterns and Scales", which the blurb on the cover hails as the first book on herpetological variations that occur naturally or through selective breeding. This volume introduces an extraordinary array of abnormalities, ranging from leopard geckos (*Eublepharis macularius*) with stripes instead of spots, to red-eared terrapins (*Trachemys scripta*) with two heads and six legs. Over 120 colour photographs illustrate the variants discussed in the text.

In another author's hands, such a book could be in danger of degenerating into a Victorian freak show, but Dr. Bechtel handles the whole topic commendably. He describes and attempts to explain the underlying causes of various aberrant forms, taking care to use such terms as 'anomaly' or 'variant', rather than the more emotive 'freak' or 'mutant'. His basic approach is that of a scientist, but the text is continually enlivened with relevant personal experiences and anecdotes.

Brief though fascinating reviews of scalelessness, bicephaly, Siamese twins and hybrids are given in the penultimate chapter, but the bulk of this book is devoted to the author's pet subject of snake colouration anomalies. He wisely opens with a good general account of normal skin structure and function in the chapters 'Biology of the Skin', 'Chromatophore Biology', 'Participation of Chromatophores in Color Pattern' and 'Function of Coloration and Pattern'. As most colour anomalies can be directly attributed to the inheritance of abnormal genes (although appearances may be modified by environmental factors, such as nutritional deficiencies or extremes of temperature during foetal development), there are also helpful chapters on genetics and investigative breeding and artifical selection. These are well laid out and easily digested, despite introducing some rather complex biological concepts. A list of carefully chosen references is appended to each chapter.

Chapters 7 to 12 are devoted to different kinds of colour variants, and I wondered how Bechtel would classify the unusual Therkupattu sand boa. It does not conform to the descriptions in chapters 7 and 8 of albinism or the many other related forms of hypomelanism; although he rightly points out that "..not all snakes with diminished melanin fit our preconceived notion of what an albino snake should look like". The plates at the end of the book show that the eyes are often pinkish as one would expect, but rather than being plain white, the body may be vividly coloured with scarlet or canary-yellow pigments. Some of the albino amphibians and reptiles shown are surreally garish.

Chapter 9 deals with axanthism (in which the animal has melanin, but little or no red and yellow pigments), whilst Chapter 20 covers leucism, piebaldism and melanism. Leucistic animals have black or blue eyes and their bodies are pure white due to a complete absence of chromatophores. Although this condition is extremely rare among reptiles, two instances of wild adult leucistic *Python molurus* were recorded earlier this century, which must have been impressive- indeed one of them was regarded sacred! Piebaldism in the term Bechtel uses for animals with white patches on an otherwise normally coloured body. This nay be genetically inherited or merely result from skin disease. A more common phenomenon among reptiles and amphibians is melanism, in which the whole body is jet black due to a surfeit of melanin. This

anomaly sometimes proves to be to the animal's advantage, and in some wild populations, melanistic individuals far outnumber the 'normal' form. All of these colour variations are clearly explained although, rather irritatingly, the reader must keep jumping to the back of the book for pictures of example specimens.

None of the aforementioned categories quite fit our aberrant *Eryx conicus*, however, and it should be consigned to Bechtel's dustbin group of 'color pattern anomalies' in Chapter 11. Several of the colour plates given under this heading show snakes which, like the sand boa are white with black eyes and sketchy pale brown markings. This particular form of colour pattern anomaly does not appear to have a name and its underlying processes are not discussed, but it is interesting to note that it has arisen in taxa as diverse as the New World colubrid *Pituophis melanoleucus* and the Old World boid *Eryx conicus*.

As pointed out by the author, the odds are greatly stacked against conspicuous anomalous snakes escaping the attention of predators and breeding successfully. (The fact that our white sand boa has survived to adulthood is probably due to its tendency to remain underground during the day.) Not surprisingly therefore, many of the specimens illustrated in this book were bred and raised in captivity, where the chances of survival and reproduction are, if anything, biased in their favour. Herpetoculture is a popular hobby and big business in countries such as the United States, Germany and the Czech Republic, and variants are actively sought and deliberately propagated through selective breeding.

It is presumably for this large market of herpetoculturalists that this book is primarily intended. However, the ongoing obsession in the West with breeding fancy varieties of herps for the pet and zoo trade is a matter which bothers me. It smacks of trying to improve on nature and may even jeopardise endangered species (such as when irresponsible owners release animals carrying deleterious genes). Why select for evermore vivid yellow *Lampropeltis getula*, when the wild form is already such a handsome and well-adapted reptile (page 102)? Is it not distasteful, perhaps even downright unethical, to deceive snakes from different genera to hybridize (pg. 97)? I sincerely hope this book will not encourage further such Frankensteinian dabblings.

Leaving that fear aside, it is only fair to point out that Bechtel's book is exhaustively researched and well presented, gives deserved attention to the subject of variants, and will appeal to anyone with an interest in reptiles or amphibians. Naturally occurring deviations from the norm are always intriguing, often incredibly attractive and can provide valuable insights into the processes of heridetary, developmental biology and evolution. On these grounds, this splendid book is wholly recommended.

Jennifer C. Daltry, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

INDIAN SNAKES by Neelimkumar Khaire. 1996. Indian Herpetological Society, Pune. 106 pp. Available from: Indian Herpetological Society, 'Usant', Pune-Satara Road, Pune 411 009, India. Price: Paperback - Indian Rupees 350.00, $30.00; Hardcover- Indian Rupees 450.00, $35.00.

Neelimkumar Khaire is one of the few acknowledged snakemen of India who has put much of his life (and an arm!) into the study and conservation of serpents. His book "Indian Snakes" (no date) is a lavishly illustrated introduction to the snakes of India that will prove useful to lay persons and herpetologists alike. Since India produces very few snake books, this is one that should also interest our colleagues abroad.

Having said this, it is only fair to describe it and point out some of the good points as well as shortcomings. The book is 106 pages in a format a bit shorter than A-4 size. Just about every page has at least one colour photograph, most of them good to excellent (though the printing seems to

anomaly sometimes proves to be to the animal's advantage, and in some wild populations, melanistic individuals far outnumber the 'normal' form. All of these colour variations are clearly explained although, rather irritatingly, the reader must keep jumping to the back of the book for pictures of example specimens.

None of the aforementioned categories quite fit our aberrant *Eryx conicus*, however, and it should be consigned to Bechtel's dustbin group of 'color pattern anomalies' in Chapter 11. Several of the colour plates given under this heading show snakes which, like the sand boa are white with black eyes and sketchy pale brown markings. This particular form of colour pattern anomaly does not appear to have a name and its underlying processes are not discussed, but it is interesting to note that it has arisen in taxa as diverse as the New World colubrid *Pituophis melanoleucus* and the Old World boid *Eryx conicus*.

As pointed out by the author, the odds are greatly stacked against conspicuous anomalous snakes escaping the attention of predators and breeding successfully. (The fact that our white sand boa has survived to adulthood is probably due to its tendency to remain underground during the day.) Not surprisingly therefore, many of the specimens illustrated in this book were bred and raised in captivity, where the chances of survival and reproduction are, if anything, biased in their favour. Herpetoculture is a popular hobby and big business in countries such as the United States, Germany and the Czech Republic, and variants are actively sought and deliberately propagated through selective breeding.

It is presumably for this large market of herpetoculturalists that this book is primarily intended. However, the ongoing obsession in the West with breeding fancy varieties of herps for the pet and zoo trade is a matter which bothers me. It smacks of trying to improve on nature and may even jeopardise endangered species (such as when irresponsible owners release animals carrying deleterious genes). Why select for evermore vivid yellow *Lampropeltis getula*, when the wild form is already such a handsome and well-adapted reptile (page 102)? Is it not distasteful, perhaps even downright unethical, to deceive snakes from different genera to hybridize (pg. 97)? I sincerely hope this book will not encourage further such Frankensteinian dabblings.

Leaving that fear aside, it is only fair to point out that Bechtel's book is exhaustively researched and well presented, gives deserved attention to the subject of variants, and will appeal to anyone with an interest in reptiles or amphibians. Naturally occurring deviations from the norm are always intriguing, often incredibly attractive and can provide valuable insights into the processes of heridetary, developmental biology and evolution. On these grounds, this splendid book is wholly recommended.

Jennifer C. Daltry, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

INDIAN SNAKES by Neelimkumar Khaire. 1996. Indian Herpetological Society, Pune. 106 pp. Available from: Indian Herpetological Society, 'Usant', Pune-Satara Road, Pune 411 009, India. Price: Paperback - Indian Rupees 350.00, $30.00; Hardcover- Indian Rupees 450.00, $35.00.

Neelimkumar Khaire is one of the few acknowledged snakemen of India who has put much of his life (and an arm!) into the study and conservation of serpents. His book "Indian Snakes" (no date) is a lavishly illustrated introduction to the snakes of India that will prove useful to lay persons and herpetologists alike. Since India produces very few snake books, this is one that should also interest our colleagues abroad.

Having said this, it is only fair to describe it and point out some of the good points as well as shortcomings. The book is 106 pages in a format a bit shorter than A-4 size. Just about every page has at least one colour photograph, most of them good to excellent (though the printing seems to

have messed up some and a few (page 37) are just plain out of focus).

On page 23 is an unnamed albino snake which should have been identified. On page 40 is a drawing of a South American boa identified as an Indian python. Some careful proof reading would have avoided awkward sentences like this one on page 57, "The prey is normally swallowed head first and does not make much movement till the food is digested" (we bet it doesn't move much!). And on page 9, "Scientists are classified into 13 families".

On page 63, the *Lycodon* is probably *jara,* not *striatus.* To update snake taxonomy, the Indian cobras are no longer a subspecies, but four valid species. The snake named *Naja oxiana* on page 82 is actually the melanistic form of *Naja naja* found over a large part of northern/western India. *Naja oxiana* is probably rare in this country and restricted to the extreme north-west, near Pakistan. King cobras are snake-eaters, yes, but they probably only rarely eat their own kind, making them only occasional cannibals.

Also, as a matter of interest the female king cobra uses her whole body to gather leaves for her nest. While sea snake antivenom is not made in India, it is worth noting that it has been produced in Japan and Australia (and is very expensive!). In the section on pet snakes it would have been good to mention two things: a) let the snake go where it was caught if it doesn't feed or do well in captivity, b) a short list of likely snakes as pets such as the striped keelback and trinket snake.

The illustration of the uropeltid feeding on an earthworm (page 41) was the first I've seen and the experiment referred to on page 28 in which a royal snake went without water for five years is quite unusual.

The book begins with general descriptions of snakes and their reptile relatives, closeup pictures of specialized features of snakes and species of special interest. Breeding, feeding, venom and snakebite is featured and most of the rest of the book is devoted to individual species descriptions. The book ends with brief sections on snakes as pets, myths, snake parks and snake worship.

All in all, "Indian Snakes" is obviously the work of someone deeply interested and devoted to this remarkable group of animals. While this is a book very few rural Indians will ever get to see or buy, it is a publication valuable to anyone with even a vague interest in Indian snakes.

Romulus Whitaker, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India.

BIBLIOGRAPHY OF THE HERPETOLOGY OF THE ANDAMAN AND NICOBAR ISLANDS

Indraneil Das and Harry V. Andrews

Centre for Herpetology, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India

A bibliography of herpetological papers, books and reports of the Andaman and Nicobars known to us is presented. The cut-off date for inclusion of entries was 12 July, 1997. Papers resulting from research supported by the Centre for Herpetology, or the Andaman and Nicobar Islands Environmental Team (Centre for Island Ecology), both divisions of the Madras Crocodile Bank Trust, have been indicated with asterisks.

ABDULALI, H. 1971. Narcondam Island and notes on some birds from the Andaman Islands. *J. Bombay nat. Hist. Soc.* 68(2): 385-411.

_____ . 1982. Some field notes on the newly described toad, *Bufo camortensis* Mansukhani & Sarkar. *J. Bombay nat. Hist. Soc.* 79(2): 430.

*ANDREWS, H. V. & R. WHITAKER. 1994. Population dynamics and ecology of the saltwater crocodile (*Crocodylus porosus*) (Schneider) in the Andaman and Nicobar Islands. Interim survey report. Phase I. Submitted to the Andaman and Nicobar Forest Department, Asian Wetland Bureau and the Centre for Herpetology (AN/C-1-94). 33 pg.

*_____ & _____ . 1994. Population dynamics and ecology of the saltwater crocodile (*Crocodylus porosus*) (Schneider) in the Andaman and Nicobar Islands. Interim survey report. Phase II. Submitted to the Andaman and Nicobar Forest Department and the Centre for Herpetology (AN/C-2-94). 18 pg.

*_____ & _____ . 1994. Status of the saltwater crocodile (*Crocodylus porosus* Schneider, 1801) in North Andaman Island. *Hamadryad* 19: 79-92.

ANNANDALE, N. 1904. Contributions to Oriental herpetology I- The lizards of the Andamans, with the description of a new gecko and a note on the reproduced tail in *Ptychozoon homalocephalum*. *J. Asiatic Soc. Bengal* 73(Suppl): 12-22.

_____ . 1905. Contributions to Oriental herpetology II- Notes on the Oriental lizards in the Indian Museum, with a list of the species recorded from British India and Ceylon. Part 1. *J. & Proc. Asiatic Soc. Bengal* n.s. 1(3): 81-93; Pl. I-II.

_____. 1905. Contributions to Oriental herpetology III- Notes on the Oriental lizards in the Indian Museum, with a list of the species recorded from British India and Ceylon. Part 2. *J. & Proc. Asiatic Soc. Bengal* n.s. 1(3): 139-151.

_____. 1905. Additions to the collection of Oriental snakes in the Indian Museum. -Part II. - Specimens from the Andamans and Nicobars. *J. Asiatic Soc. Bengal* 73(2): 173-176.

BARBE, P. 1846. Notes of Nicobar Islands. *J. Asiatic Soc. Bengal* 15: 344-366.

BAYLEY-DE-CASTRO, A. 1927. A case of snake-bite due to Cantor's viper (*Lachesis cantoris*). *J. Bombay nat. Hist. Soc.* 32(1): 223-224.

*BHASKAR, S. 1979. Sea turtles in the South Andaman Islands. *Hamadryad* 4(1): 3-6.

* _____. 1980. Sea turtle survey in the Andaman and Nicobars. *Hamadryad* 4(3): 2-26.

* _____. 1981. Sea turtle surveys of Great Nicobar and Little Andaman Islands. Report to the WWF-I. 5 pg.

* _____. 1981. Travels in the Andaman and Nicobar Islands- 1979. *Hamadryad* 6(1): 2-8.

* _____. 1984. Sea turtles in North Andaman and other Andaman islands. Report to the WWF-I. 46 pg.

* _____. 1984. Locating and conserving sea turtle nesting grounds in the Andamans. *In*: Spirit of Enterprise. The 1984 Rolex Awards. pp: 190-193. Aurum Press, London.

* _____. 1984. The distribution and status of sea turtles in India. *In*: Proc. Workshop Sea

Turtle Conserv. pp: 21-35. E. G. Silas (Ed.) Central Marine Fisheries Research Institute Spec. Publ. No. 18. CMFRI, Cochin.

*_____ . 1993. The status and ecology of sea turtles in the Andaman and Nicobar Islands. Centre for Herpetology, Madras Crocodile Bank Trust. Publication No. ST 1/93. 37 pg.

*_____ . 1996. Renesting intervals of the hawksbill turtle (*Eretmochelys imbricata*) on South Reef Island, Andaman Islands, India. *Hamadryad* 21: 19-22.

*_____ . 1996. Sea kraits on South Reef Island, Andaman Islands, India. *Hamadryad* 21: 27-35.

*_____ & H. V. ANDREWS. 1993. Action Plan for sea turtles in the Andaman and Nicobar Islands, India. *Mar. Turtle Newsl.* (60): 23.

*_____ G. C. RAO. 1992. Present status of some endangered animals in Nicobar Islands. *J. Andaman Sci. Assoc.* 8: 181-186.

*_____ & R. WHITAKER. 1983. Sea turtle resources in the Andamans. *In*: Mariculture potential in Andaman and Nicobar Islands - An indicative survey. *Bull. Cent. Mar. Fish. Res. Inst.* 34: 94-97.

BISWAS, S. 1985. Some notes on the reptiles of the Andaman and Nicobar Islands. *J. Bombay nat. Hist. Soc.* 81: 476-481.

_____ & D. P. SANYAL. 1965. A new species of wolf-snake of the genus *Lycodon* Boie [Reptilia: Serpentes: Colubridae] from the Andaman and Nicobar Islands. *Proc. Zool. Soc. Calcutta* 18: 137-141.

_____ & _____ . 1977. Notes on the Reptilia collection from the Great Nicobar Island during the Great Nicobar Expedition in 1966. *Rec. Zool. Surv. India* 72: 107-124.

_____ & _____ . 1977. A new species of skink of the genus *Dasia* Gray, 1889 (Reptilia: Scincidae). *J. Bombay nat. Hist. Soc.* 74: 133-136.

_____ & _____ . 1978. A new species of krait of the genus *Bungarus* Daudin, 1803 [Serpentes: Elapidae] from the Andaman Island. *J. Bombay nat. Hist. Soc.* 75: 179-183

_____ & _____ . 1980. A report on the Reptilia fauna of Andaman and Nicobar Islands in the collection of the Zoological Survey of India. *Rec. Zool. Surv. India* 77: 255-292.

BLYTH, E. 1846. Notes on the fauna of the Nicobar Islands. *J. Asiatic. Soc. Bengal* 15: 367-379.

_____1863. The zoology of Andaman Islands. *In*: Adventures and researches among the Andaman Islanders. pp: 345-367. F. J. Mouat (author). *J. Asiatic Soc. Bengal* 32: i-viii + 1-367. Reprinted 1979, 1989, as 'The Andaman Islanders' by Mittal Publications, New Delhi.

CHERCHI, M. A. 1954. Una nuova sotto specie di *Kaloula baleata* delle Isole Andamane. *Doriana (Genova)* 1(47): 1-4.

CHOUDHURY, B. C. & H. R. BUSTARD. 1979. Predation on natural nests of the saltwater crocodile (*Crocodylus porosus* Schneider) on North Andaman Island with notes on the crocodile population. *J. Bombay nat. Hist. Soc.* 75(2): 43-49.

CROMBIE, R. I. 1986. The status of the Nicobar toads *Bufo camortensis* Mansukhani & Sarkar, 1980 and *Bufo spinipes* Fitzinger *in* Steindachner, 1867. *J. Bombay nat. Hist. Soc.* 83: 226-229.

DANIELS, R. J. R. & P. V. DAVID. 1996. The herpetofauna of the Great Nicobar Island. *Cobra.* 25: 1 - 4

*DAS, I. 1994. A check-list of the amphibians and reptiles of Andaman and Nicobar Islands. *J. Andaman Sci. Association* 10 (1 & 2): 44-49.

* _____. 1995. A new tree frog (genus *Polypedates*) from Great Nicobar, India (Anura: Rhacophoridae). *Hamadryad* 20: 13-20.

* _____. 1996. *Limnonectes shompenorum*, a new frog of the *Rana macrodon* (Anura: Ranidae) complex from Great Nicobar, India. *J. S. Asian nat. Hist.* 2(1): 60-67.

* _____. 1996. Geographic distribution: *Rana chalconota* (copper-cheeked frog). *Herpetol. Rev.* 27(1): 30.

* _____. 1996. The validity of *Dibamus nicobaricum* (Fitzinger *in* Steindachner, 1867)(Squamata: Sauria: Dibamidae). *Russian J. Herpetol.* 3(2): 157-162.

* _____. 1997. Rediscovery of *Lipinia macrotympanum* (Stoliczka, 1873) from the Nicobars Islands, India. *Asiatic Herpetol. Res.* 7: 23-26.

*_____ . 1997. A new species of *Cyrtodactylus* from the Nicobar Islands, India. *J. Herpetol.* 31(3): 375 - 382.

*_____ & K. CHANDRA. 1994. Two snakes new to Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.* 10 (1 & 2): 114-115.

DAVIS, T. A. & R. ALTEVOGT. 1976. Giant turtles and robber crabs of the South Sentinel. *Yojana* 20(13): 75-79.

DERANIYAGALA, P. E P. 1944. Four new races of the 'kabaragoya' lizard *Varanus salvator*. *Spolia Zeylanica* 24: 59-62; Pl. 10-12.

_____ . 1947. The names of the water monitors of Ceylon, the Nicobars and Malaya. *Proc. Third Ann. Sess. Ceylon Assoc.* Sec. 2. Abstr. 12.

_____ . 1961. The water monitor of the Andaman Islands- a distinct subspecies. *Spolia Zeylanica* 29(2): 203-204.

GANS, C. 1955. Localities of the herpetological collections made during the "Novara Reise". *Ann. Carnegie Mus.* 33: 275-285.

GROSSMANN, W. 1987. *Cyrtodactylus rubidus* (Blyth). *Sauria, Berlin* 9(3): 2.

HUSSAIN, S. A. 1984. Some aspects of the biology and ecology of Narcondam hornbill (*Rhyticeros narcondami*). *J. Bombay nat. Hist. Soc.* 81(1): 1-18.

*KAR, C. S. & S. BHASKAR. 1982. Status of sea turtles in the eastern Indian Ocean. *In*: Biology and conservation of sea turtles. pp: 365-372. K. A. Bjorndal (Ed.) Smithsonian Institution Press, Washington, D.C.

KHAN, I. H. 1987. Conservation of endangered marine species in Andamans. *In*: Proc. Symp. Manage. Coastal Ecosystems & Oceanic Res. Andamans. pp: 66-70. Andaman Science Association, Port Blair.

LAL MOHAN, R. S. 1983. Marine turtle resources. *Bull. Cent. Mar. Fish. Res. Inst.* 34: 98-99.

_____ . 1983. Saltwater crocodile resources. *Bull. Cent. Mar. Fish. Res. Inst.* 34: 102-103.

LANZA, B. 1952. Su un esemplare di *Pelamis platyurus* (L.) catturato in un fiume della piccola Andaman (Serpentes; Hydrophiidae). *Monitore Zoologico Italiano* 62(2): 67-70.

MANSUKHANI, M. R. & A. K. SARKAR. 1980. On a new species of toad from Camorta, Andaman and Nicobar, India. *Bull. Zool. Surv. India* 3: 97-101.

MEHTA, H. S. & G. C. RAO. 1987. Microhylid frogs of Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.* 3: 98-104.

MOHANRAJ, P. & K. VEENAKUMARI. 1996. Perspectives on the zoogeography of the Andaman and Nicobar Islands, India. *Malayan Nature J.* 50:99-106.

MURTHY, T. S. N. 1983. Rediscovery of the blind snake *Typhlops oatesii* in Andamans, India. *The Snake* 15: 48-49.

_____. 1987. Curious reptiles of Andamans. *Sci. Reporter* 18: 32-36.

OTA, H., T. HIKIDA & M. MATSUI. 1991. Re-evaluation of the status of *Gecko verreauxi* Tytler, 1864, from the Andaman Islands, India. *J. Herpetol.* 25(2): 147-151.

PANDE, P., A. KOTHARI & S. SINGH (Eds.) 1991. Directory of National Parks and Sanctuaries in Andaman and Nicobar Islands. Management status and profiles. Indian Institute of Public Administration, New Delhi. 171 pp.

PILLAI, R. S. 1977. On two frogs of the family Microhylidae from Andamans including a new species. *Proc. Indian Acad. Sci.* 86: 135-138.

_____. 1991. Contribution to the amphibian fauna of Andaman and Nicobar with a new record of the mangrove frog, *Rana cancrivora*. *Rec. Zool. Surv. India* 88(1): 41-44.

RAO, G. C. 1987. Sea turtles in the Bay Islands. *The Daily Telegrams* 189: 8-17.

_____& M. K. DEV ROY. 1985. The fauna of the Bay Islands. *J. Andaman Sci. Assoc.* 1(1 & 2): 1-17.

_____& I. H. KHAN. 1989. On the present status of the marine fauna of the Andaman Sea. *Zoologiana* 5: 29-42.

_____, B. MITRA & P. T. RAJAN. 1990. A biological exploration of the Barren Island. *J. Andaman Sci. Assoc.* 6(2): 138-144.

_____& H. S. MEHTA. 1986. Frogs and toads in Bay Islands. *The Daily Telegrams* 186: 12-19.

*RATNAM, J. 1992. Distribution and behavioural ecology of the Andaman day gecko (*Phelsuma andamanensis*). Masters Dissertation, Sálim Ali School of Ecology, Pondicherry University, Pondicherry. 110 pg.

*_____ . 1993. Status and natural history of the Andaman day gecko, *Phelsuma andamanensis*. *Dactylus* 2(2): 59-66.

SARKAR, A. K. 1990. Taxonomic and ecological studies on the amphibians of Andaman and Nicobar Islands, India. *Rec. Zool. Surv. India* 86: 103-117.

SAXENA, A. 1994. Captive breeding of the Malayan box turtle (*Cuora amboinensis*) from the Nicobar Islands. *Hamadryad* 19: 93-94.

SCLATER, W. L. 1891. Notes on the collection of snakes in the Indian Museum with descriptions of several new species. *J. Bombay nat. Hist. Soc.* 60(3): 230-250; Pl. VI.

SEKAR, A. G. 1984. Distribution of *Bufo camortensis* Mansukhani & Sarkar in the Andaman and Nicobar Islands. *J. Bombay nat. Hist. Soc.* 81(2): 488.

*SHETTY, S. 1996. Studies on the terrestrial behaviour of the yellow-lipped sea krait (*Laticauda colubrina*) in the Andaman Islands. M. Sc. Dissertation, Sálim Ali School of Ecology, Pondicherry University, Pondicherry. 44 pg + 2 maps.

*_____ & K. V. DEVI PRASAD. 1996. Studies on the terrestrial behaviour of *Laticauda colubrina* in the Andaman Islands, India. *Hamadryad* 21: 23-26.

*_____ & _____ . 1996. Geographic variation in the number of bands in *Laticauda colubrina*. *Hamadryad* 21: 44-45.

*SIVASUNDAR, A. 1995. Sea turtle survey of South Reef (June-July 1995). A preliminary report. Report to the Andaman and Nicobar Environmental Team/Madras Crocodile Bank Trust. 3 pg.

*_____ . 1996. Studies on the nesting of leatherback sea turtles (*Dermochelys coriacea*) in the Andaman Islands. M. Sc. Dissertation, Sálim Ali School of Ecology, Pondicherry University, Pondicherry. 41 pg + 6 pl.

*_____ . & K. V. DEVI PRASAD. 1996. Placement and predation of nest in leatherback sea turtles in the Andaman Islands, India. *Hamadryad* 21: 36-42.

SMITH, M. A. 1940. The herpetology of the Andaman and Nicobar Islands. *Proc. Linn. Soc.* 1940: 150-158.

STEINDACHNER, F. 1867. Zoologischer Theil, Band 1. Reptilien. *In:* Reise der österreichischen Fregatte Novara um die Erde in der Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wüllerstorf-Urbair. Kaiserlich-Königlischen Hof-und Staatsdruckerei, Wien. 98 pp + Pl. I-III.

STOLICZKA, F. 1870. Observations on some Indian and Malayan Amphibia and Reptilia. *Proc. Asiatic Soc. Bengal* 1870(4): 103-109

_____. 1870. Observations on some Indian and Malayan Amphibia and Reptilia. *J. Asiatic Soc. Bengal* 39(2): 134-157 + captions, Pl. IX.

_____. 1870. Observations on some Indian and Malayan Amphibia and Reptilia. *J. Asiatic Soc. Bengal* 39(3): 159-228, Pl. X-XII.

_____. 1872. Notes on various new or little known Indian lizards. *J. Asiatic Soc. Bengal* 41(1): 86-116; Pl. II-V.

_____. 1873. Notes on some Andamanese and Nicobarese reptiles. *Proc. Asiatic Soc. Bengal* (5): 118.

_____. 1873. Note on some Andamanese and Nicobarese reptiles with descriptions of three species of lizards. *J. Asiatic Soc. Bengal* 42(3): 162-169.

TIKADER, B. K., A. DANIEL & N. V. SUBBA RAO. 1986. Sea shore animals of Andaman & Nicobar Islands. Zoological Survey of India, Calcutta. xii + 188 pp.

_____& A. K. DAS. 1985. Glimpses of animal life of Andaman & Nicobar Islands. Zoological Survey of India, Calcutta. xi+ 170 pp.

TIWARI, K. K. 1961. The eggs and flight of gecko *Ptychozoon kuhli* Stejneger from Car Nicobar. *J. Bombay nat. Hist. Soc.* 58: 523-526.

_____. 1973. Two new reptiles from the Great Nicobar Island. *J. Zool. Soc. India* 25: 57-63.

*TIWARI, M. 1992. First record of the sunbeam snake *Xenopeltis unicolor* Reinwardt, 1827 (Serpentes: Xenopeltidae) from Great Nicobar Island. *J. Bombay nat. Hist. Soc.* 89: 383.

*_____ . 1996. Les tortues de la mer des iles d'Andamans et Nicobars. *In*: International Congress of Chelonian Conservation. Proceedings. pp: 50-51. SOPTOM (Ed.) Editions Soptom, Gonfaron.

TYTLER, L. C. R. C. 1864. Observations on a few species of geckos alive in the possession of the author. *J. Asiatic. Soc. Bengal* 33: 535-548.

*WHITAKER, R. 1978. Herpetological survey in the Andamans. *Hamadryad* 3: 9-16.

*_____ . 1978. Birth record of the Andaman pit viper, *Trimeresurus purpureomaculatus*. *J. Bombay nat. Hist. Soc.* 75(1): 233.

*_____ . 1982. An Andaman experience. *Sanctuary Asia* 2(4): 316-325.

*_____ . 1983. Crocodile resources in the Andaman and Nicobars. Marine potential. *Bull. Cent. Mar. Fish. Res. Inst.* 34: 100-101.

*_____ . 1985. Rational use of estuarine and marine reptiles. *In*: Proc. Symp. Endangered Mar. Animals & Mar. Parks. 1: 298-303. Cent. Mar. Fish. Res. Inst. Spec. Publ. 18. CMFRI, Cochin.

*_____ . 1985. Managing tropical moist forests. Endangered Andamans. Environmental Services Group, WWF- India/MAB India and Department of Environment, Government of India. New Delhi. 51 pp.

* _____. 1990. Why did they call it Snake Island? *Daily Telegrams, Port Blair*: 16 May, 1990.

* _____. 1991. Suspected case of death by pit viper bite. *Hamadryad* 16: 37.

* _____. 1993. Eco-development and wildlife management in the Andaman and Nicobar Archipelago. *In*: Spirit of Enterprise. The 1993 Rolex Awards. pp: 332-334. D. W. Reed (Ed.) Buri International, Bern.

* _____. 1994. Some environmental issues facing the Andaman and Nicobar Islands. *In*: Andaman and Nicobar Islands- challenges for development. pp: 97-106. V. Suryanarayan & V. Sundersen (Eds.). Konark Pub., New Delhi.

* _____. & Z. WHITAKER. 1978. A preliminary survey of the saltwater crocodile (*Crocodylus porosus*) in the Andaman Islands. *J. Bombay nat. Hist. Soc.* 76: 311-325.

* _____& _____ . 1978. Notes on *Phelsuma andamanense*, the Andaman day gecko or green gecko. *J. Bombay nat. Hist. Soc.* 75(2): 497-499.

* _____& _____ . 1989. The status and conservation of the Asian crocodilians. *In*: Crocodiles: their ecology, management and conservation. pp: 297-308. IUCN Special Publication, IUCN, Gland.

NEW BOOKS

GECKO FAUNA OF THE USSR AND CONTIGUOUS REGIONS

Hardcover, with xi + 233 pages.
By N. N. Szczerbak and M. L. Golubev

Price: US$ 48.00
Publisher: Society for the Study of Amphibians and Reptiles
English translation (1996) from the 1986 Russian text. ISBN 0-916984-39-7

The 1996 English language translation of the 1986 Russian text, originally published by Naukova Dumka, Kiev. Includes eight colour plates, showing 24 gekkonoid lizards. Contents include: Foreword; General Section; Systematic Section; Literature Cited; Alphabetical Index of Russian Names of Animals; Alphabetical index of Latin Names of Animals.

Order from: Dr. Robert D. Aldrich, Publications Secretary, Society for the Study of Amphibians and Reptiles, Department of Biology, Saint Louis University, Saint Louis, Missouri 63103, USA. Telephone: ++314 977 3916; 977 1710; Fax: ++314 977 3658; email: ssar@sluvca.slu.edu.

CROCODILE FEVER

WILDLIFE ADVENTURES IN NEW GUINEA

Paperback, with about 156 pages
By Rom and Zai Whitaker

Price: Indian Rupees 575.00 (Indian Rupees 460.00 before 31 August, 1997)
Publisher: Orient Longman. Expected date of publication: September 1997. Original edition: 1997
ISBN 81 250 0083 6

Crocodile Fever is at once a travelogue, a fascinating adventure story and an authentic record of little known information about the wildlife and the people of Papua New Guinea.

This is an account of the two years the authors, Rom and Zai Whitaker, spent in Papua New Guinea. Later, Roms work took him up through the western half of the island, the Indonesian province of Irian Jaya- through rivers and swamps and exotic places that few outsiders have ever seen. New Guinea with its spectacular wildlife comes alive in this book.

This book is a record of the authors incredible, moving and sometimes hilarious experiences in strange and beautiful places, through uncharted rivers and natural settings. The land, the tribal groups, the crocodiles and other animals are described with equal love and enthusiasm.

The text is richly interspersed with vivid colour as well as black and white photographs, illustrations and maps.

Special features include authentic information text in boxes giving specific and colourful details about New Guinea, its people and all the creatures that abound there.

172 mm x 240 mm, about 200 photographs, illustrations and maps in black and white and full colour.

Order from: Orient Longman Ltd., 3-6-272, Himayatnagar, Hyderabad 500 029, India.

INDIAN SNAKES

Hardcover and paperback editions
By Neelimkumar Khaire

Price: Hardcover (Indian Rupees 450.00 or US$ 35.00); paperback (Indian Rupees 350.00 or US$ 30.00)
Publisher: Indian Herpetological Society
Original edition: 1996

An illustrated guide to the common Indian snakes, containing some good colour photographs. Contents include: Foreword; Evolution; Classification; Scientific Names; Anatomy; Habitat; Reproduction; Feeding Habits; Enemies and Defence; Venom; Snakes of India; I want a snake as a pet?; Snakes and Misbeliefs; Snake Parks; Snake Worship; Snakes on Stamps; Identification Key.
Order from: Indian Herpetological Society, 'Usant', Pune Satara Road, Pune 411 009, Maharashtra, India.

FRESHWATER TURTLES

A COLOURING BOOK FOR CHILDREN

Paperback, with 24 pages, colour wrapper
By Indraneil Das

Price: Indian Rupees 50 (each) or Indian Rupees 400 (for 10 copies) for India and other SAARC; US$ 5 (each) or US$ 40 (for 10 copies) for rest of the world (inclusive of airmail postage)
Publisher: Peoples Trust for Endangered Species, London. Original edition: 1996

A guide to the freshwater turtles of India, including line drawings of species, their habitats and often, other animals and plants that share their habitats. Also includes vernacular names in Indian languages, natural history notes, why the species are in danger, and how to colour the pictures. Proceeds from the sale of these books will be used in other herpetological conservation related publications.
Order from: Indraneil Das, Centre for Herpetology, Madras Crocodile Bank Trust, Post Bag 4, Mamallapuram, Tamil Nadu 603 104, India. Fax: 91-44-491-0910; 91-04114-42511.